a guide to the geology of the Capron-Rockford area

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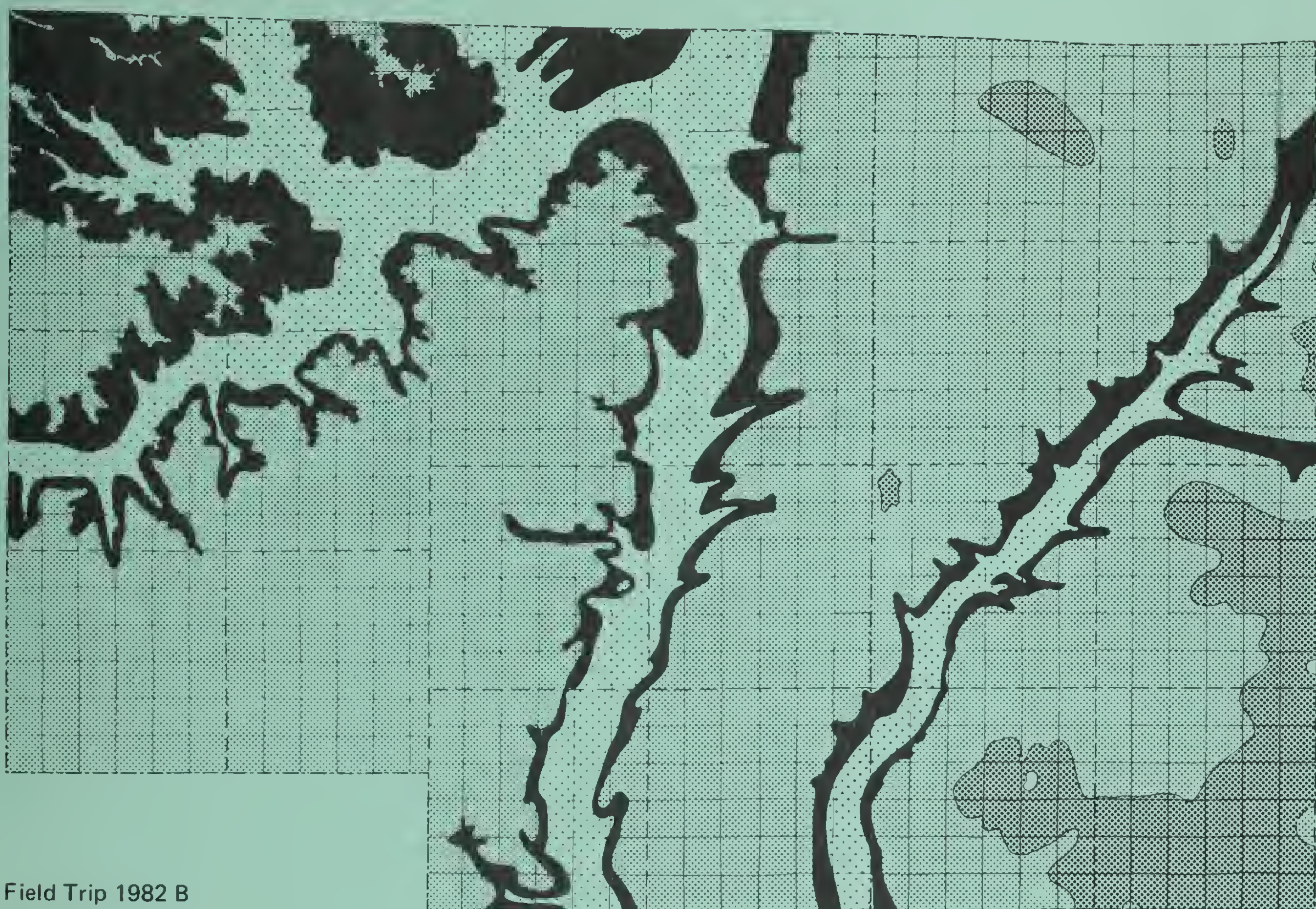

Field Trip 1982 B
May 15, 1982

Department of Energy and Natural Resources
State Geological Survey Division
Champaign, IL 61820

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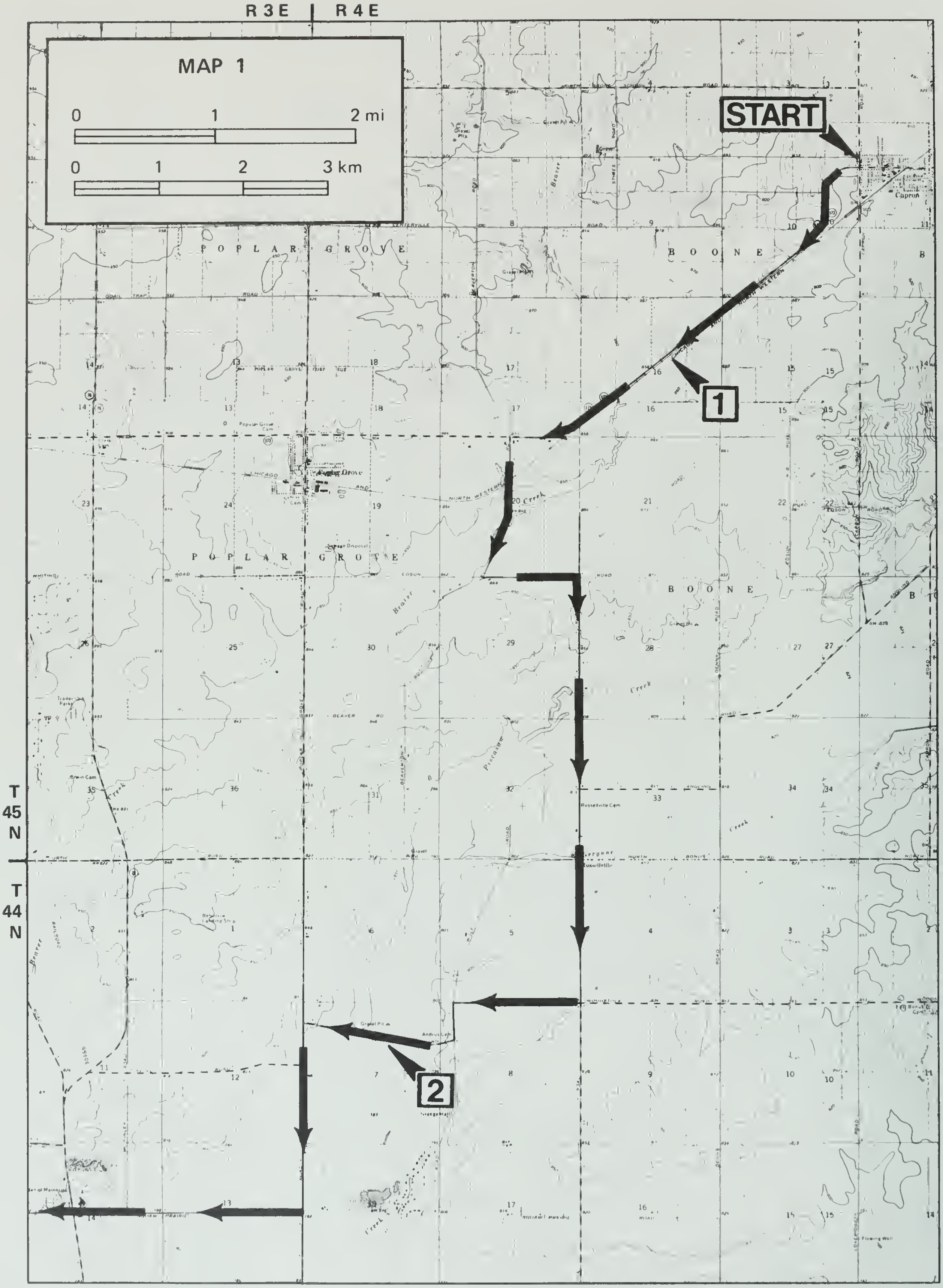

R 3 E
R 4 E
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1
2 mi
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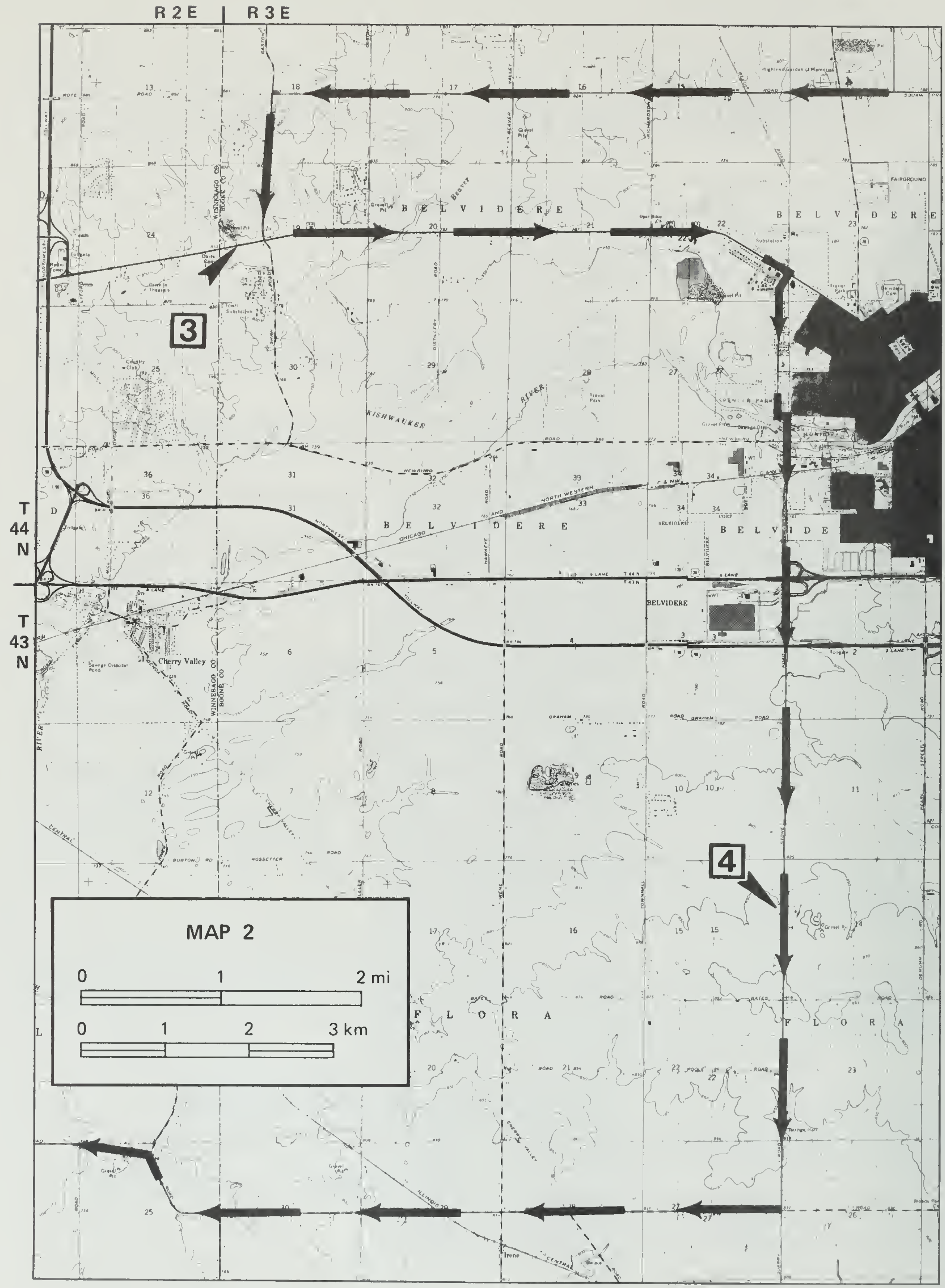
3 km
START
1
2
T 45 N
T 44 N
P O P L A R G R O V E
B O O N E
Poplar Grove
Capron
Russellville Cem

guide to the route

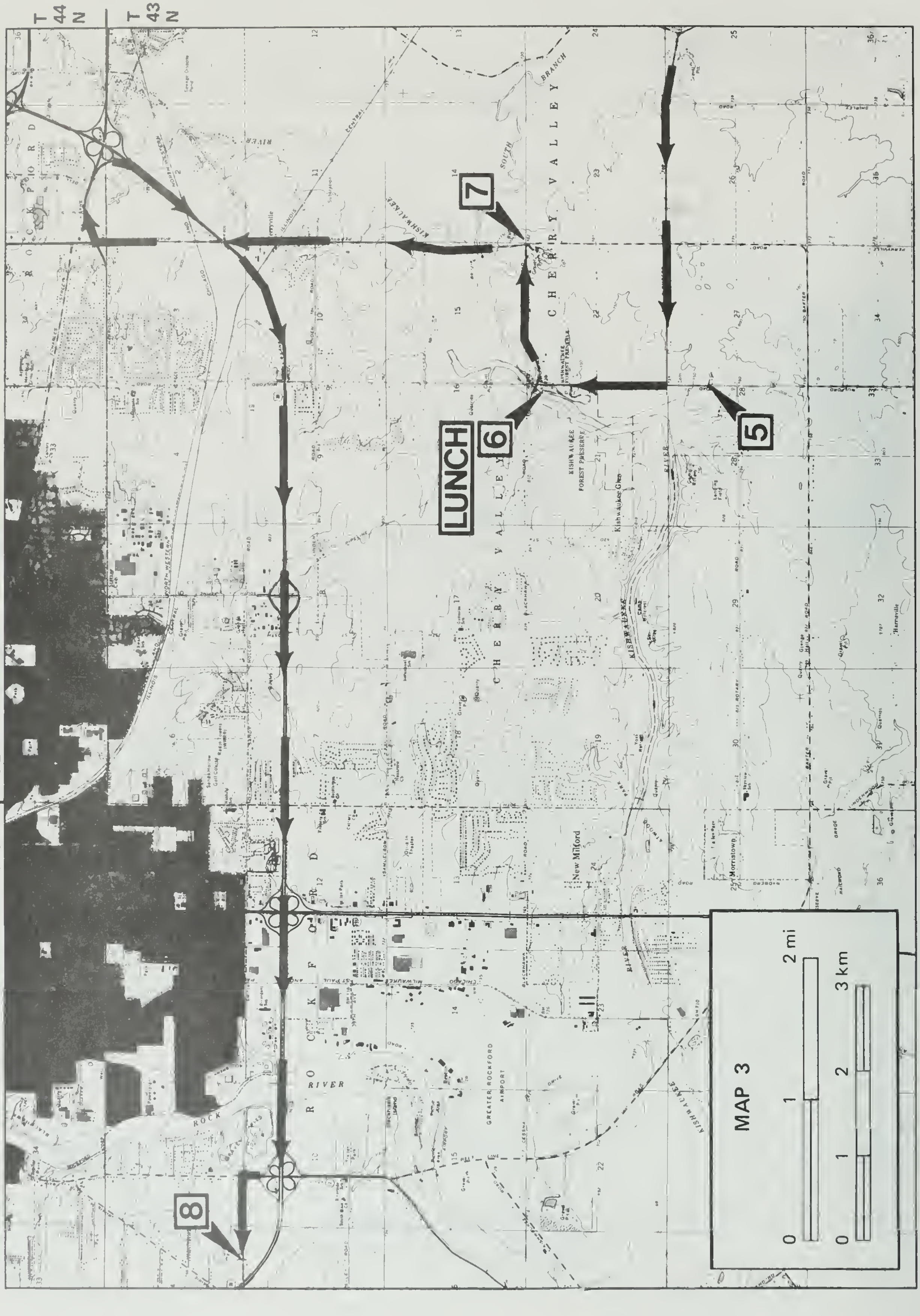
Miles to next point	Miles to starting point	
		Line up facing east along the south side of the Capron Elementary School parking lot.
0.0	0.0	Leave entrance to parking lot. TURN RIGHT (south) on Wooster Street.
0.05+	0.05+	STOP (2-way); West Main Street. TURN RIGHT (west) on State Route (SR) 173.
0.95-	1.0	The area ahead and to the right (north) for about 5 miles contains the headwaters of Beaver Creek, one of the principal drainage ways in the field trip area. Note low, marshy areas on the right side of the road.
1.0	2.0	Prepare to park along highway.
0.1	2.1	PARK ON RIGHT SIDE OF HIGHWAY, as far off the road as possible. USE CAUTION in walking across SR 173 to view the fen from the Chicago and Northwestern (C & NW) railroad crossing. LOOK OUT FOR TRAINS.
		☐ **STOP 1.** **Discussion of geologic conditions that helped form the fen southeast of the railroad.**
0.0	2.1	Leave Stop 1. CONTINUE AHEAD (southwest) on SR 173.
0.6	2.7	Note the gently rolling character of the glaciated landscape here.
0.6	3.3	Prepare to turn left.
0.1+	3.4+	TURN LEFT (south) on Beaverton Road.
0.3	3.7+	CAUTION: UNGUARDED (C & NW) railroad crossing.
0.1-	3.8	Note sharp, small meanders in the small stream to right that flows southward into Beaver Creek.
0.1	3.9	CAUTION: one-lane bridge across Beaver Creek. To right, just beyond bridge, is the wide floodplain of Beaver Creek, up to the toe of the terrace on which the homes are located.
0.55-	4.45-	CAUTION: Y-intersection. TURN LEFT (east) on Edson Road.
0.25+	4.7	View to right (south) of Piscasaw Creek lowlands.

Miles to next point	Miles to starting point	
0.4+	5.1+	CAUTION: crossroad. TURN RIGHT (south) on Russelville Road.
0.65-	5.75	View ahead and to left of Piscasaw Valley. Note meanders to the right as you start to descend the valley wall. The creek meanders because it has a very low gradient (bottom profile slope) across the flat bottomland here.
0.2-	5.95-	Cross Piscasaw Creek.
0.05+	6.0	View ahead and slightly to the left of a terrace along the south side of Piscasaw Creek valley. Note the rise in the road ahead leading up on the terrace.
0.4	6.4	The itinerary now crosses the top of the terrace.
0.25	6.65	The upland 1.5 miles to the south-southeast is the south valley wall of Piscasaw Creek. This broad valley (about 2 miles wide here) was formed by a tremendous volume of water flowing off the melting ice that stood to the north and east of here.
0.45	7.1	Cross Geryune Creek. CONTINUE AHEAD (south). This small creek, now one of the major drainage lines of this broad area, could not have eroded this wide valley.
1.05-	8.15-	STOP (2-way). TURN RIGHT (west) on Woodstock Road.
0.9	9.05-	STOP (1-way); T-road intersection. TURN LEFT (south) on Grange Hall Road.
0.25+	9.3	CAUTION: T-road intersection. TURN RIGHT (west) on Woodstock Road.
0.1	9.4	View ahead and to right and left of the upper terrace level. Note the evenness of the ground surface here and from one side of the creek to the other.
0.15+	9.55+	Cross Piscasaw Creek. Note narrow floodplain (upstream and downstream) above which is a well-formed lower terrace level. As we proceed, note the well-defined upper terrace level.
0.15-	9.7	Prepare to park on shoulder of road.
0.1	9.8	CAUTION: PARK along north side of Woodstock Road. BE CAREFUL of traffic from both directions!
		☐ **STOP 2.** **Discussion of terrace levels along Piscasaw Creek.**
0.0	9.8	CAUTION: leave Stop 2. CONTINUE AHEAD (west).

Miles to next point	Miles to starting point	
0.5	10.3	Route ascends onto the upland adjacent to the valley.
0.1-	10.4-	STOP (1-way); T-road intersection. TURN LEFT (south) on Belvidere-Poplar Grove Road.
1.25	11.65-	Prepare to turn right.
0.1	11.75-	TURN RIGHT (west) on Squaw Prairie Road.
0.35+	12.1	Watertower to left is in Belvidere. The route here is along the northern edge of the confluence of the large Piscasaw Creek Valley and the smaller Kishwaukee River valley.
0.8	12.9	View to right (northwest) of the Boone County landfill site, the large hill with the heavy equipment on top.
0.45	13.35	STOP (2-way); SR 76. CONTINUE AHEAD (west) on Squaw Prairie Road.
0.7-	14.05-	STOP (2-way); Beloit Road. CONTINUE AHEAD (west).
0.65+	14.7	STOP (2-way); Richardson Road. CONTINUE AHEAD (west).
1.0+	15.7+	STOP (2-way); Beaver Valley Road. CONTINUE AHEAD (west) and descend into valley of Beaver Creek.
0.5-	16.2	Cross Beaver Creek. Note the broad valley and the relatively small size of the present stream.
0.55-	16.75-	STOP (2-way); Olson Road. CONTINUE AHEAD (west).
0.7	17.45	STOP (2-way). TURN LEFT (south) on Shaw Road.
1.05	18.5-	STOP (2-way). CAUTION: TURN RIGHT (west) on US 20 Business Route, State Street.
0.1	18.6-	Prepare to turn right.
0.1	18.7-	TURN RIGHT (north) into the State Street Quarry.
0.05	18.75-	Enter State Street Quarry Office of Schlichting and Sons Excavating Company. You MUST have permission to enter this property.
		☐ **STOP 3.** **Discussion of Winnebago Formation till members and the underlying dolomite of the Ordovician Galena Group.**
0.0	18.75-	Leave Stop 3. Retrace itinerary to US 20.
0.05+	18.8	STOP (1-way). TURN LEFT (east) on US 20 Business Route. Use EXTREME CAUTION—fast cross-traffic!
1.2	20.0	Cross Beaver Creek.
2.6	22.6	CAUTION: enter Belvidere.


R2E
R3E
T
44
N
T
43
N
3
4
B E L V I D E R E
BELVIDERE
Cherry Valley
KISHWAUKEE
RIVER
NORTH WESTERN
F L O R A
MAP 2
0
1
2 mi
0
1
2
3 km

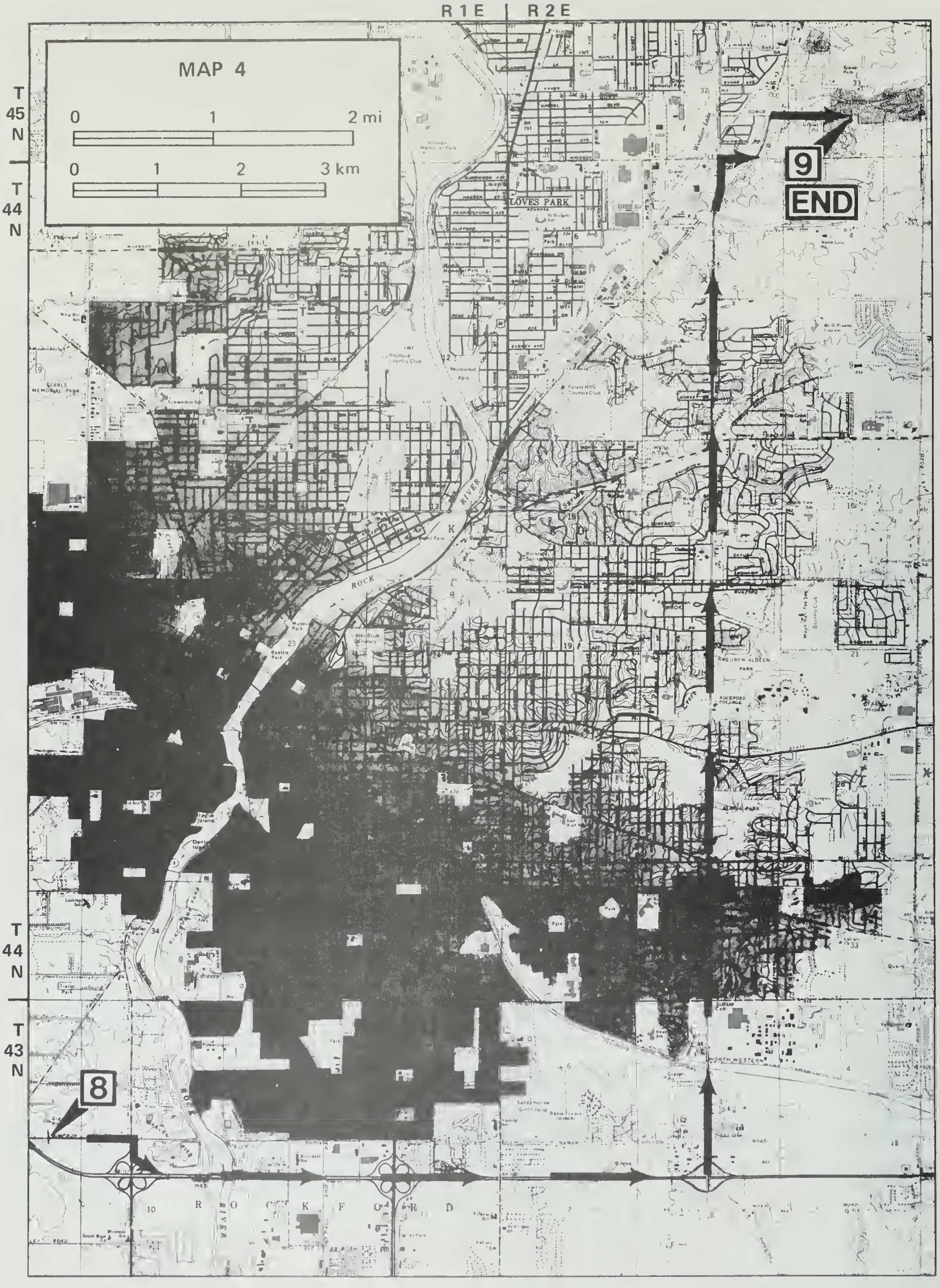
Miles to next point	Miles to starting point	
0.25	22.85	CAUTION: STOPLIGHT. TURN RIGHT (south-southwest) on Appleton Street.
0.15	23.0	BEAR LEFT (south) on Appleton Street.
0.9-	23.9-	TURN LEFT (east) on West Lincoln Avenue.
0.05+	23.95	TURN RIGHT (south) on Stone Quarry Road.
0.05+	24.0+	Cross north channel of Kishwaukee River.
0.15-	24.15	Cross south channel of Kishwaukee River.
0.1	24.25	STOP (4-way); Newburg Road. CONTINUE AHEAD (south) on Stone Quarry Road.
0.1	24.35	CAUTION: (C & NW) railroad crossing.
0.1	24.45	CAUTION: (C & NW) railroad crossing.
0.45	24.9	BEAR RIGHT on divided road near US 20 interchange.
0.05	24.95	To the left (south-southeast), the slumping of earth materials in the interchange embankment has produced small, step-like features that rotated as they slid down the slope.
0.2	25.15	US 20 overpass. CONTINUE AHEAD (south).
0.1	25.25	Belvidere Works, Chrysler Corporation to right.
0.4	25.65	Cross Illinois toll road.
1.6	27.25	Powerline crossing. CONTINUE AHEAD (south) and prepare to park.
0.3	27.55	PARK on west shoulder of Stone Quarry Road. Use EXTREME CAUTION because of traffic from both directions. Do NOT BLOCK the road.
		☐ **STOP 4.** **Discussion of bedrock exposure of the Ordovician Maquoketa Group in low roadcut on east side of Stone Quarry Road.**
0.0	27.55	CAUTION: leave Stop 4. CONTINUE AHEAD (south).
0.6	28.18	In the distance (to the right) is a cooling tower for the Byron Nuclear Power Station. A drill hole near this road corner indicated the presence of 50 feet of glacial drift.
1.4	29.55	Prepare to turn right.
0.1	29.65	TURN RIGHT (west) on Bloodspoint Road.
0.1+	29.75+	Natural gas pipeline crossing.
1.45-	31.2	STOP (2-way); Cherry Valley Road. CONTINUE AHEAD (west).
0.45+	31.65+	STOP (2-way); Irene Road. CONTINUE AHEAD (west) on Bloodspoint Road.


T 44 N
T 43 N
R1E | R2E
MAP 3
0 1 2 mi
0 1 2 3 km
LUNCH
5
6
7
8
ROCKFORD
CHERRY VALLEY
KISHWAUKEE FOREST PRESERVE
New Milford
Morristown
GREATER ROCKFORD AIRPORT
ROCK RIVER
KISHWAUKEE RIVER
SOUTH BRANCH

Miles to next point	Miles to starting point	
0.45-	32.1	Powerline crossing and Illinois Central Gulf (ICG) railroad overpass. CONTINUE AHEAD (west).
0.8	32.9	View (to left) of abandoned small hillside quarry.
1.05	33.95	CURVE RIGHT (northwest) onto River Road.
0.45	34.4	CAUTION: Y-intersection. BEAR LEFT (west-northwest) onto Blomberg Road.
0.05+	34.45+	Cross south branch of Kishwaukee River. View to left (west and west-southwest) of a prominent glacial kame behind barn.
1.5-	35.95	STOP (2-way); Perryville Road. CONTINUE AHEAD (west) on Blomberg Road.
1.0	36.95	STOP (1-way); T-road intersection. TURN LEFT (south) on Mulford Road.
0.2	37.15	Prepare to park on the right shoulder.
0.1	37.25	PARK on right shoulder of Mulford Road. USE EXTREME CAUTION: visibility from the south is not good!
		☐ **STOP 5.** **Discussion of Esmond Till exposed along both sides of roadcut.**
0.0	37.25	Leave Stop 5. TURN AROUND and HEAD NORTH on Mulford Road.
0.9	38.15	Prepare to turn left.
0.1+	38.25+	TURN LEFT (west) at entrance to Kishwaukee River Forest Preserve. USE EXTREME CAUTION: poor visibility from traffic from the north.
0.3	38.55+	Cross narrow stone culverts.
0.05-	38.6	T-road from left. CONTINUE AHEAD (north-northeast).
0.3	38.9	PARK so as not to block traffic. LUNCH in the adjoining picnic area.
		☐ **STOP 6.** **Discussion of drainage changes as related to the bedrock of the area.**
0.0	38.9	Leave Stop 6. Retrace route to Mulford Road.
0.3	39.2	T-road from right. CONTINUE AHEAD AND BEAR LEFT uphill.
0.35-	39.55-	STOP (1-way); T-road intersection. TURN LEFT (north) on Mulford Road. USE EXTREME CAUTION: poor visibility to and from the north.
0.25	39.8-	STOP (1-way); T-road intersection. TURN RIGHT (east) on Blackhawk Road.

Miles to next point	Miles to starting point	
0.55	40.35-	View to right of northwest portion of kame at Stop 7.
0.25	40.6-	View to right of same kame, partially obscured by brush.
0.2+	40.8	STOP (1-way); T-road intersection. TURN RIGHT (south) on Perryville Road; immediately TURN RIGHT (southwest) again toward gate of gravel pit.
0.05-	40.85-	Entrance gate to gravel pit. You MUST HAVE PERMISSION to enter this property.
		☐ **STOP 7.** **Discussion of internal structure and occurrence of glacial kames.**
0.0	40.85-	Leave Stop 7. Retrace route to Perryville Road.
0.05-	40.90-	STOP (1-way); T-road intersection. TURN LEFT (north) on Perryville Road.
0.1+	41.0	Descend south valley wall of the Kishwaukee River.
0.25-	41.25-	Cross South Branch Kishwaukee River.
0.1	41.35-	Cross Kishwaukee River.
0.3	41.65	Ascend the north valley wall of the Kishwaukee River.
1.0+	42.65	CAUTION: (ICG) railroad crossing (2 tracks) at Perryville.
0.4	43.05	Cross US 20.
0.2	43.25	Cross (C & NW) railroad overpass.
0.7+	43.95+	CAUTION: STOPLIGHT. TURN RIGHT (east) on Harrison Avenue.
0.25-	44.2	CAUTION: STOPLIGHT; entrance to Cherryvale Mall. CONTINUE AHEAD (east and south) on Harrison Avenue; keep in outside lane.
0.25	44.45+	BEAR RIGHT toward US 20 (west) to Freeport.
0.35	44.8+	CAUTION: MERGE LEFT onto US 20 (west).
0.45	45.25+	Cross (C & NW) railroad overpass.
0.35	45.6+	Perryville Road overpass.
0.35	45.95+	(ICG) railroad overpass.
0.7	46.65+	CAUTION: US 51 Interchange. CONTINUE AHEAD (west) on US 20.
1.45	48.1+	Alpine Road exit to right. CONTINUE AHEAD (west) on US 20.
0.55	48.65+	Note stone quarry to right.

Miles to next point	Miles to starting point	
1.7-	50.35	CAUTION: US 51 Interchange. CONTINUE AHEAD (west) on US 20.
0.45	50.8	CAUTION: MERGING TRAFFIC FROM RIGHT. CONTINUE AHEAD (west).
0.25	51.05	Burlington Northern (BN) railroad overpass.
0.65	51.7	Cross Rock River.
0.15	51.85	Cross west channel of Rock River.
0.1	51.95	View to right (north) of gravel pit operated in a low terrace along the Rock River.
0.25	52.2	BEAR RIGHT (north) to Main Street and SR 2 (north).
0.25	52.45	USE EXTREME CAUTION: MERGE LEFT AND GET IN CENTER LANE of divided highway; prepare for left turn.
0.15-	52.6-	CAUTION: TURN LEFT (west) on Simpson Road.
0.25+	52.85	View to right (north) of the Rockford Terrace; ice-contact features can be seen in the upper part.
0.3+	53.15+	TURN RIGHT (north) into abandoned gravel pit, the Simpson Road pit of the Rockford Blacktop Construction Company. You MUST have permission to enter this property.
		☐ **STOP 8.** **Discussion of Rockford Terrace gravels and ice-contact features.**
0.0	53.15+	Leave Stop 8. Retrace route to entrance gate and resume mileage from there.
0.05-	53.2	STOP (1-way). TURN LEFT (east) on Simpson Road.
0.45	53.65	View straight ahead shows east valley wall of the Rock River in the distance.
0.15-	53.8-	STOP (2-way); Main Street. TURN RIGHT (south) on SR 2.
0.25+	54.05	CAUTION: US 20 Interchange. BEAR RIGHT (east) onto US 20 toward Belvidere.
0.3	54.35	Cross SR 2 and MERGE LEFT onto US 20.
0.25	54.6	CAUTION: traffic merges from right. CONTINUE AHEAD (east).
0.25	54.85	Cross west channel of Rock River.
0.15	55.0	Cross main channel of Rock River.
0.95	55.95	US 51 Interchange. CONTINUE AHEAD (east) on US 20.
0.5	56.45	CAUTION: traffic merges from right.


MAP 4
0 1 2 mi
0 1 2 3 km
R1E
R2E
T 45 N
T 44 N
T 44 N
T 43 N
9
END
8
LOVES PARK
ROCK RIVER
ROCKFORD

Miles to next point	Miles to starting point	
1.6	58.05	Prepare to turn right.
0.15	58.2	BEAR RIGHT (southeasterly) toward Alpine Road.
0.25+	58.45+	CAUTION: STOPLIGHT. TURN LEFT (north) on Alpine Road.
0.1-	58.55	Cross US 20.
0.1+	58.65+	CAUTION: STOPLIGHT. CONTINUE AHEAD (north).
0.2-	58.85	CAUTION: STOPLIGHT; Sandy Hollow Road. CONTINUE AHEAD (north).
0.3	59.15	Here the route crosses the upland between the Rock River and the bedrock valleys of the ancient Rock and Troy Rivers.
0.2	59.35	Cross ICG and C & NW railroad overpass.
0.05	59.4	Enter Rockford.
0.25	59.65	CAUTION: STOPLIGHT. CONTINUE AHEAD (north).
0.2-	59.85-	CAUTION: STOPLIGHT; Harrison Avenue. CONTINUE AHEAD (north) on Alpine Road.
0.45	60.3-	CAUTION: STOPLIGHT; Cleveland Avenue. CONTINUE AHEAD (north).
0.3+	60.6	CAUTION: STOPLIGHT; Louisiana Road. CONTINUE AHEAD (north).
0.25	60.85	CAUTION: STOPLIGHT; Broadway. CONTINUE AHEAD (north).
0.1	60.95	CAUTION: STOPLIGHT.
0.1	61.05	CAUTION: STOPLIGHT; entrance to Colonial Village. CONTINUE AHEAD.
0.15+	61.2+	CAUTION: STOPLIGHT; Larson Avenue. CONTINUE AHEAD (north) past Alpine Park.
0.45-	61.65	CAUTION: STOPLIGHT; State Street. CONTINUE AHEAD (north).
0.2	61.85	CAUTION: STOPLIGHT. CONTINUE AHEAD (north).
0.65	62.5	CAUTION: STOPLIGHT; Guilford Road. CONTINUE AHEAD (north).
0.3	62.8	CAUTION: STOPLIGHT; Guilford Road. CONTINUE AHEAD (north).
0.35-	63.15-	CAUTION: STOPLIGHT; High Crest Road. CONTINUE AHEAD (north).
0.7+	63.85	CAUTION: STOPLIGHT; Spring Creek Road. CONTINUE AHEAD (north) on Alpine Road.

Miles to next point	Miles to starting point	
0.75+	64.6+	CAUTION: STOPLIGHT. CONTINUE AHEAD (north).
0.8	65.4+	CAUTION: STOPLIGHT; Riverside Avenue. CONTINUE AHEAD (north).
0.35	65.75+	CAUTION: traffic merges from right. Prepare to turn right ahead.
0.15	65.9+	CAUTION: STOPLIGHT. TURN RIGHT (east) on Windsor Road and GET INTO INSIDE LANE.
0.25-	66.15	STOP (1-way); T-road intersection. TURN LEFT (north) on Forest Hills Road (4-lane divided highway here).
0.15-	66.3-	CAUTION: 2-way traffic ahead.
0.2+	66.5	TURN RIGHT (east) on Nimtz Road.
0.6	67.1	TURN LEFT (northeasterly) at entrance to Nimtz Quarry, Rockford Blacktop Construction Company.
0.05	67.15	Enter office of Nimtz Quarry. You MUST have permission to enter this property.
		☐ **STOP 9.** **Discussion of Ordovician bedrock and Pleistocene glacial tills.**
0.0	67.15	Leave Stop 9. Return to quarry entrance.
		END OF FIELD TRIP. PLAN TO ATTEND THE FALL FIELD TRIPS WITH US.

the geologic framework

A GEOLOGIC PICTURE OF THE AREA

The geologic materials present in the Capron-Rockford area can be categorized generally as

- the Precambrian granite that forms the basement rocks.
- the sedimentary rocks (shale, sandstone, dolomite) or the Cambrian, Ordovician, and Silurian Systems.
- the unconsolidated Quaternary material, consisting usually of softer clays and sand and gravel of glacial origin.

Precambrian rocks, usually referred to as basement rocks, solidified from magma about 1.2 to 1.5 billion years ago. At the beginning of the Paleozoic Era the crust of the earth beneath Illinois sagged until seas covered the region. Thick layers of sediment, composed of mud, sand and lime, gradually accumulated. These deposits formed the basic sedimentary rock groups of shale, sandstone, and dolomite. During the Paleozoic much of Illinois subsided; the resulting depression is called the Illinois Basin. The Capron-Rockford area lies on a slope of a slightly warped-up feature known as the Wisconsin Arch. The Illinois Basin is to the south. All rock layers dip to the southeast. Between Rockford and southern Boone County, for example, the Precambrian surface drops 320 feet to the southeast. In southern Boone County, a well penetrated the top of granite at a depth of 2925 feet, while near Rockford, another well reached granite at a depth of 2656 feet.

The granite and sedimentary rocks are usually called the bedrock. Ordovician dolomite (solidified sediment of cemented limy particles from shells and crusts of marine animals) is the surficial bedrock (the bedrock directly underlying the glacial materials) throughout most of the area. Ordovician sandstone (cemented beach or alluvial sands) is the surficial material in deep bedrock valleys; Ordovician shale (cemented fine-grained mud) is the surficial bedrock in southeastern Boone County. Three small areas of Silurian dolomite also occur in south and eastern Boone County. The sedimentary bedrock units range in age from 490 to 405 million years.

The bedrock units generally dip (slope) in a southeastward direction with the youngest rocks at the bedrock surface in southeastern Boone County. While a complete succession of all rock units shown on figure 1 once covered the entire area, erosion has removed almost all of the younger Silurian and most of the Maquoketa (Upper Ordovician) rocks. The sedimentary rocks are as much as 2700 feet thick in southeastern Boone County.

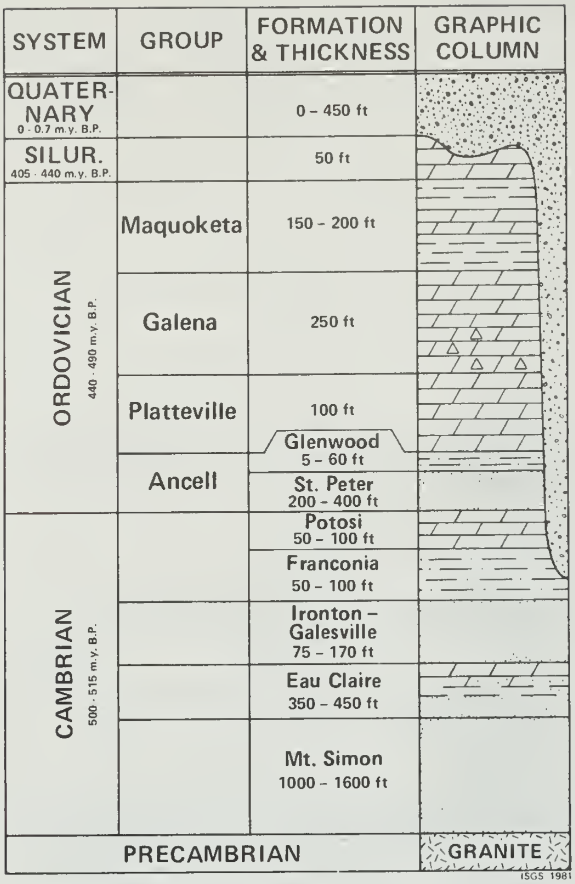


FIGURE 1. Stratigraphic column for Boone and Winnebago Counties.

Erosion that took place before the deposition of the glacial deposits left a series of deep valley systems carved into the bedrock. Partly because of this extremely uneven bedrock surface, and partly because of erosion, the glacial drift is unevenly distributed throughout the Boone and Winnebago Counties, varying in thickness from more than 450 feet in northeastern Boone County and about 300 feet under parts of the city of Rockford to only a thin veneer (0-20 ft) throughout parts of southern Boone County.

The Quaternary glacial materials (drift) were moved onto the land by glaciers, streams, and winds over the last million years or so. These deposits are mostly till--a mixture of pebbly clay, silt, and sand deposited directly from the melting glacier--or materials carried out from the glacier by the meltwater and redeposited in meltwater rivers or lakes. Outwash deposits of sand and gravel deposited by the rapidly flowing meltwater rivers are usually more than 50 feet thick in the Rock, Piscasaw, and Kishwaukee Valleys. The wide, flat areas in these valleys are called terraces. Variations in the elevations of terraces suggest that glacial meltwater episodes took place at different times. Another type of sand and gravel deposit, called a kame, was formed when sand and gravel was deposited in direct contact with the glacial ice; therefore, it is called an ice contact deposit. Windblown sand and silt, called loess, and the more recent river deposits (alluvium), slope wash (colluvium), peat, and muck, are found throughout the field trip area.

Rock and mineral products in the area are broken and crushed stone from the dolomite, and sand and gravel from the outwash and ice-contact deposits. Groundwater is readily available from the near-surface dolomite, deeper sandstone and from the outwash.

ORDOVICIAN ROCKS

Figure 2 shows the surficial distribution of Ordovician rocks in the area--the dolomite of the Galena and Platteville Groups, the shale of the Maquoketa Group, and the St. Peter Sandstone of the Ancell Group.

St. Peter Sandstone. The St. Peter Sandstone, of the Ancell Group, is a fine- to coarse-grained sandstone averaging 270 feet thick. It underlies thick glacial deposits in the deeply cut bedrock valleys and is widely used as a groundwater reservoir (aquifer).

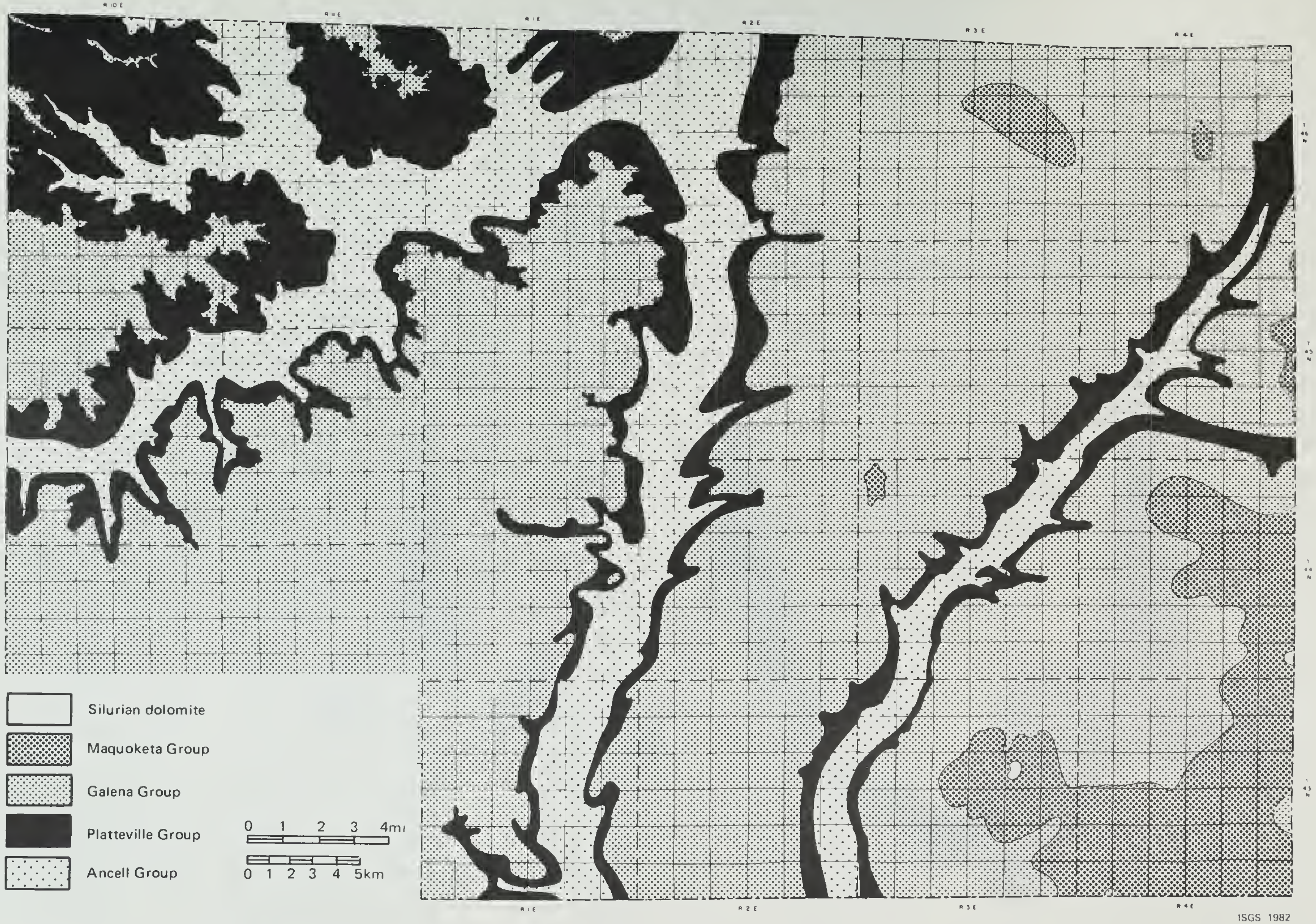
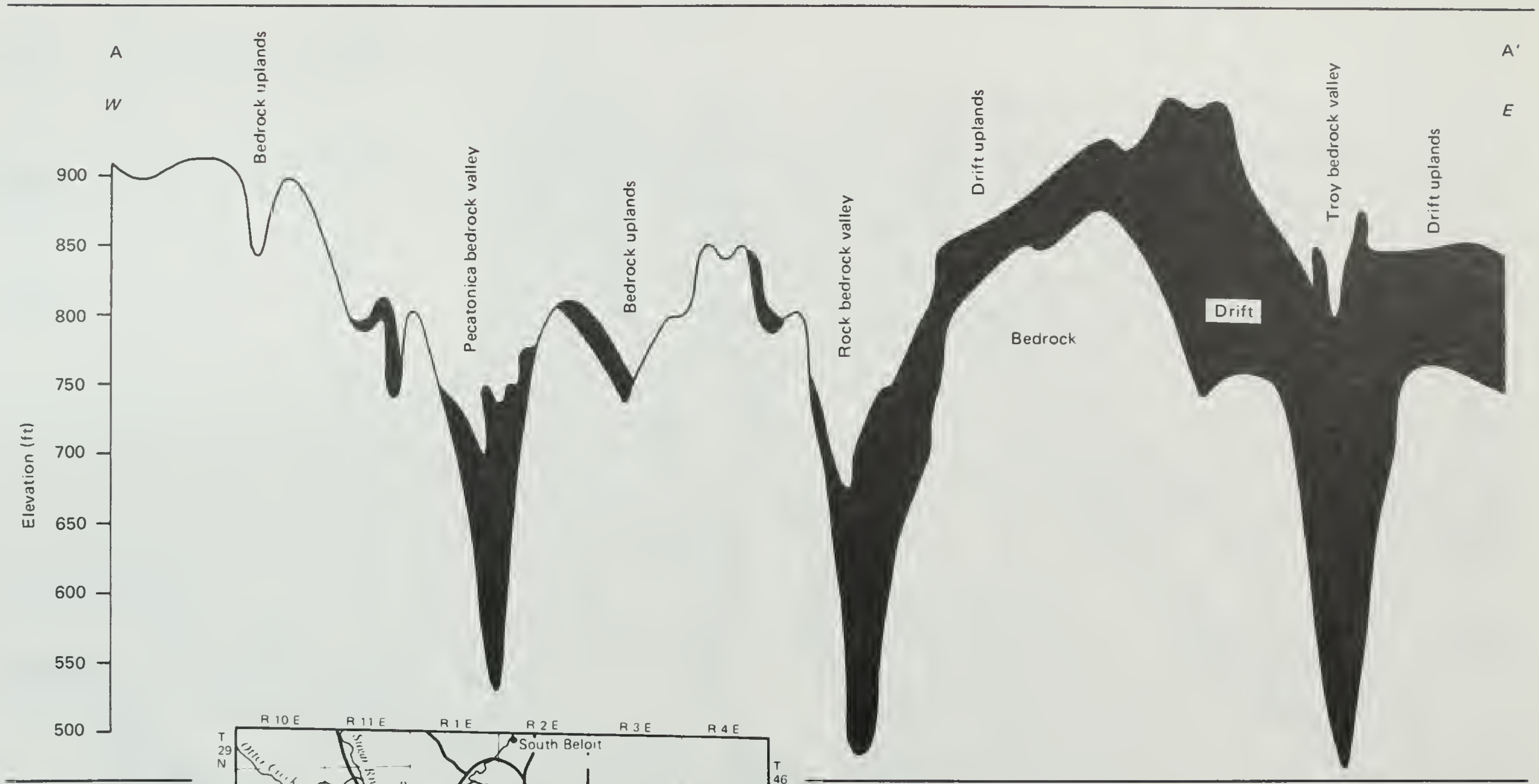


FIGURE 2. Areal geology of the bedrock surface.



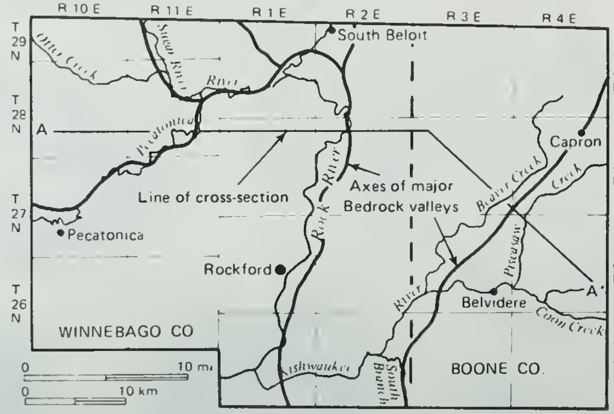


FIGURE 3. Generalized west-east cross section through Boone and Winnebago Counties showing relationship of bedrock topography to drift thickness, particularly in deep bedrock valleys.

Galena and Platteville Groups. The uppermost bedrock units over most of the field trip area are dolomite of the Galena and Platteville Groups. In general, dolomite of Platteville formations is finer grained and thinner bedded than overlying Galena formation dolomite and is gray rather than brown; however, some Platteville formations resemble the Galena. The groups have a combined maximum thickness of over 350 feet. The Platteville is as much as 137 feet thick at Rockford, while the Galena is about 250 feet thick in southeastern Boone County, where overlain and protected from erosion by the Maquoketa shale. The original thickness of the Galena dolomite has been reduced significantly by erosion outside of the Maquoketa boundary.

These dolomites are generally a dependable source of groundwater. Joints, bedding planes, fractures and solution openings normally provide an adequate water supply for farmsteads and other residences.

Maquoketa Shale Group. Rocks of the Maquoketa Shale Group are present in southeastern Boone County (fig. 2), where they average about 50 feet thick. Consisting mostly of shale with dolomite stringers, the Maquoketa shale overlies dolomite of the Galena Group. Because the shale is tightly packed, the Maquoketa is not considered a reliable groundwater source, although small supplies are obtained in some places. Where it is present, the Maquoketa shale is a hydrogeologic barrier between the surface and deeper, water-yielding formations.

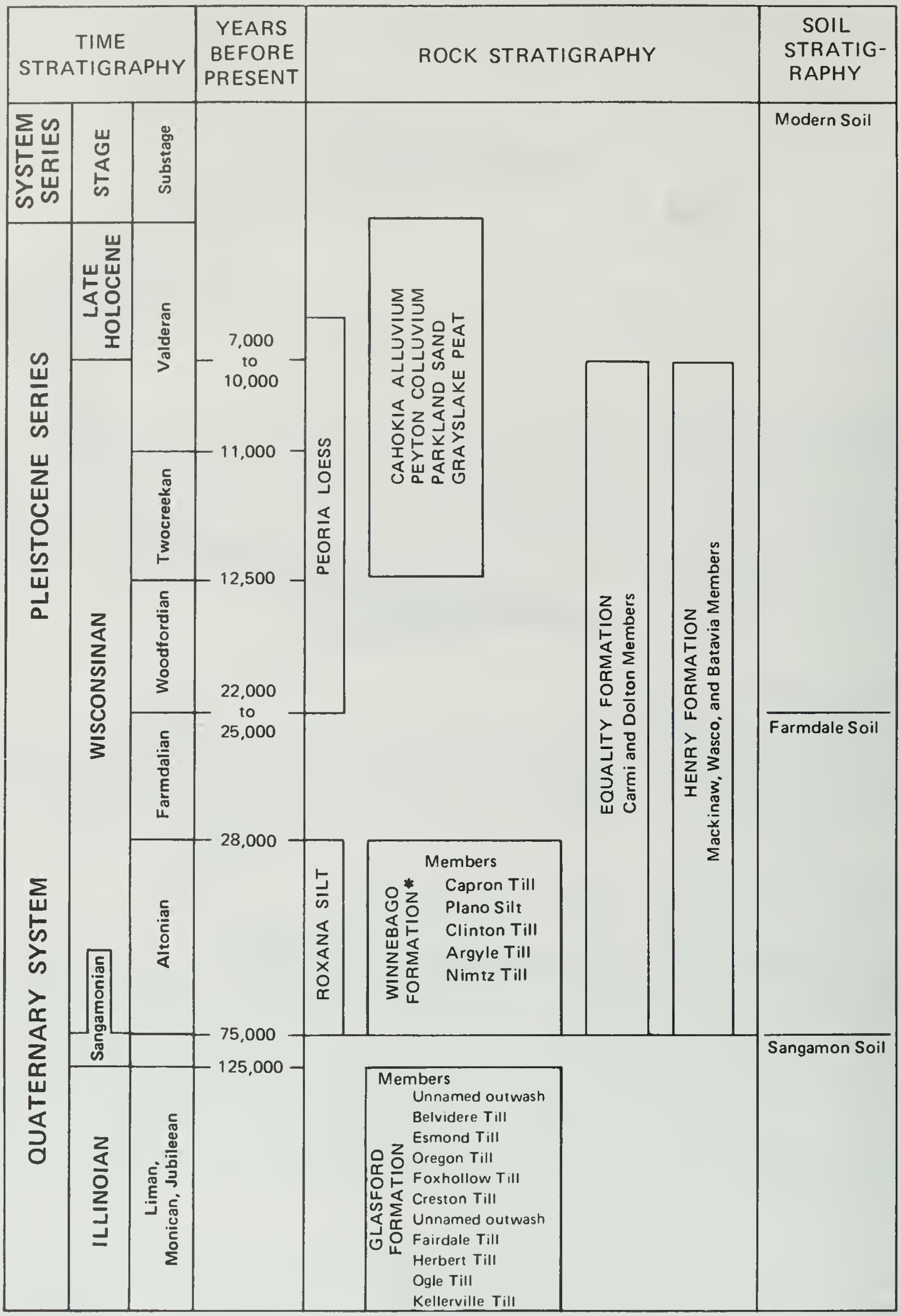
SILURIAN ROCKS

Silurian rocks occur as the upper bedrock, overlying Maquoketa shale, in three restricted locations in southern and eastern Boone County (fig. 2). The maximum thickness here is about 20 feet. The rocks are characterized as yellowish-gray to light olive-gray dolomites and dolomitic shales.

BEDROCK TOPOGRAPHY AND DRIFT THICKNESS

During the long interval between the deposition of the bedrock formations and the advance of the continental glaciers over the region, stream erosion dissected and removed much of the younger rock. By early glacial time this erosion had carved most of the major topographic features of the present bedrock surface. Subsequent erosive action by the glaciers or by streams during the melting of the glaciers completed the final stages of erosion of the bedrock surface. This surface of erosion is now largely buried or masked by glacial deposits. The thickness of the drift depends largely on the amount of glacial debris deposited, the amount of subsequent erosion of these deposits, and irregularities in the bedrock surface.

The bedrock topography of the field trip area is dominated by two major bedrock valleys, the Rock and Troy Bedrock Valleys. In these ancient valleys the thickest drift has been deposited. Figure 3 is a cross section across northern Boone and Winnebago Counties, perpendicular to the axes of the Pecatonica, Rock, and Troy Bedrock Valleys. The diagram shows the general distribution of drift over the area and compares the degree of infilling, depth, and configuration of the three bedrock valleys. The Pecatonica-Sugar-Rock Valley in Winnebago County has up to 300 feet of drift and the Troy Bedrock Valley in Boone County has more than 450 feet of drift. The uplands between



* All Winnebago Formation tills might be of Illinoian rather than Wisconsinan age.

ISGS 1982

FIGURE 4. Geologic column of surficial materials.

the bedrock valleys can be grouped into two main areas in the Capron-Rockford area: east of the Rock and northwest of the Troy Bedrock Valleys, drift is usually more than 50 feet thick and in many places more than 100 feet thick; east of the Rock Bedrock Valley and south and east of the Troy Bedrock Valley, drift is usually between 50 and 100 feet thick. However, drifts of less than 50 feet are found in many areas. In places where the drift is less than 50 feet thick, it is generally the bedrock topography that determines the local topography (relief).

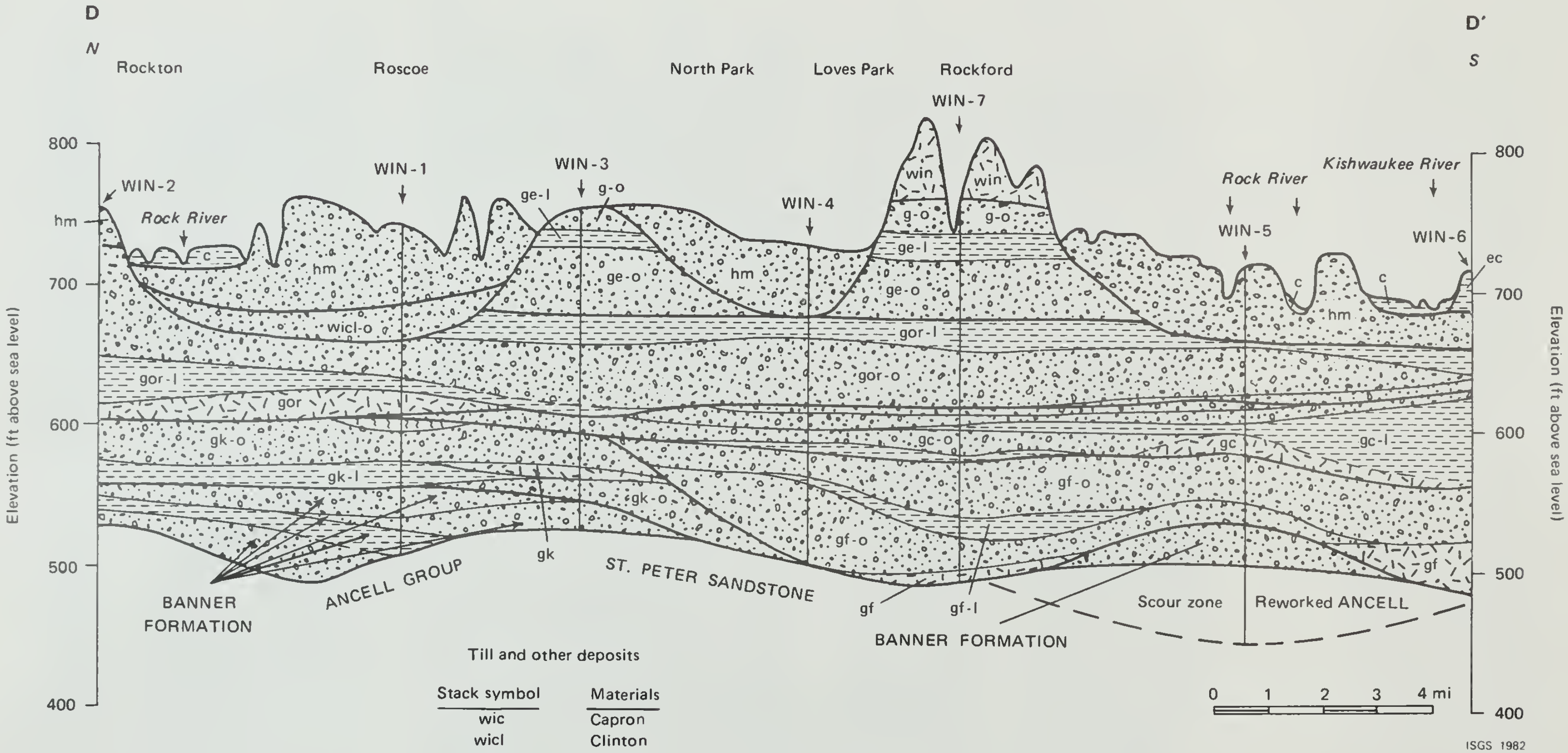
GLACIAL MATERIALS

The most extensive surficial deposits in the Capron-Rockford area are tills, most of which are sandy. Till deposited as glaciers melted was the sediment near the base of the glacier that was mixed in with the ice. Traditionally, it was thought that the tills of the field trip area were all deposited by an ice lobe originating from the Lake Michigan Basin; however, now it is thought that some of the tills originated from a source near Green Bay. The Capron, Clinton, Argyle, Nimtz, Oregon and Fairdale Till Members—all probably Illinoian in age—have recently been differentiated. The Argyle and Nimtz Tills will be seen in the field trip. Age relationships are shown in figure 4. A silty-clay till, the Esmond Member, which occurs as the principal surficial unit in southwestern Boone County and extreme southeastern Winnebago County, will also be seen. (Some of the stratigraphic terms used here have not been published previously and are currently being defined formally.)

The Woodfordian ice advances, beginning about 22,000 years ago, did not enter the field trip area. From high places in Boone County, however, the Marengo Ridge, the Woodfordian margin, can be seen to the east in McHenry County. Although this ice did not advance over the area, enormous amounts of sand and gravel from melting glaciers to the north and east supplied the material that filled in the Rock and Kishwaukee-Piscasaw Valleys with their most recent deposits. There has been little significant deposition since that time. Evidence suggests that the Rock and Troy Bedrock Valleys accumulated outwash sand and gravel from melting glaciers, possibly dating back to pre-Illinoian time. In figure 5, which shows a cross section down the axis of the Rock Bedrock Valley, the Woodfordian materials (shown by the symbol hm) comprise only about 50 to 100 feet of the total 250 feet of infilling. Also present are lake sediments (designated by short dashed lines) that probably were formed when glaciers to the south blocked the flowage of water and created large lakes in the Rock Valley.

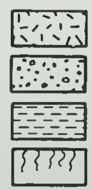
A cross section down the axis of the Troy Bedrock Valley (fig. 6) shows that the sand, gravel, and lake deposits have been covered by till. Therefore, in northern Boone County it is impossible to tell from the surface topography that a deeply incised bedrock valley is present below it. The Troy Bedrock Valley can still be seen, however, in southwestern Boone County, where it merges with the Kishwaukee Valley. The Kishwaukee River and Piscasaw Creek Valleys, for the most part, were glacial meltwater channels from glaciers to the east. About 50 to 100 feet of sand and gravel is present.

Some of the more recent deposits in the field trip area are windblown silt (loess) and sand. The loess accumulated during the Wisconsinan glaciation as glaciers advanced and receded. Loess deposits were formed when winds blew



Till and other deposits

Stack symbol	Materials
wic	Capron
wicl	Clinton
wia	Argyle
win	Nimtz
gb	Belvidere
ge	Esmond
gor	Oregon
gc	Creston
gf	Fairdale
gh	Herbert
go	Ogle
gk	Kellerville
g-o	Glasford outwash
-l or ec	Lacustrine
-o or hm	Outwash
c	Alluvium



Specific borings indicated

FIGURE 5. North-south cross section along Rock River Valley.

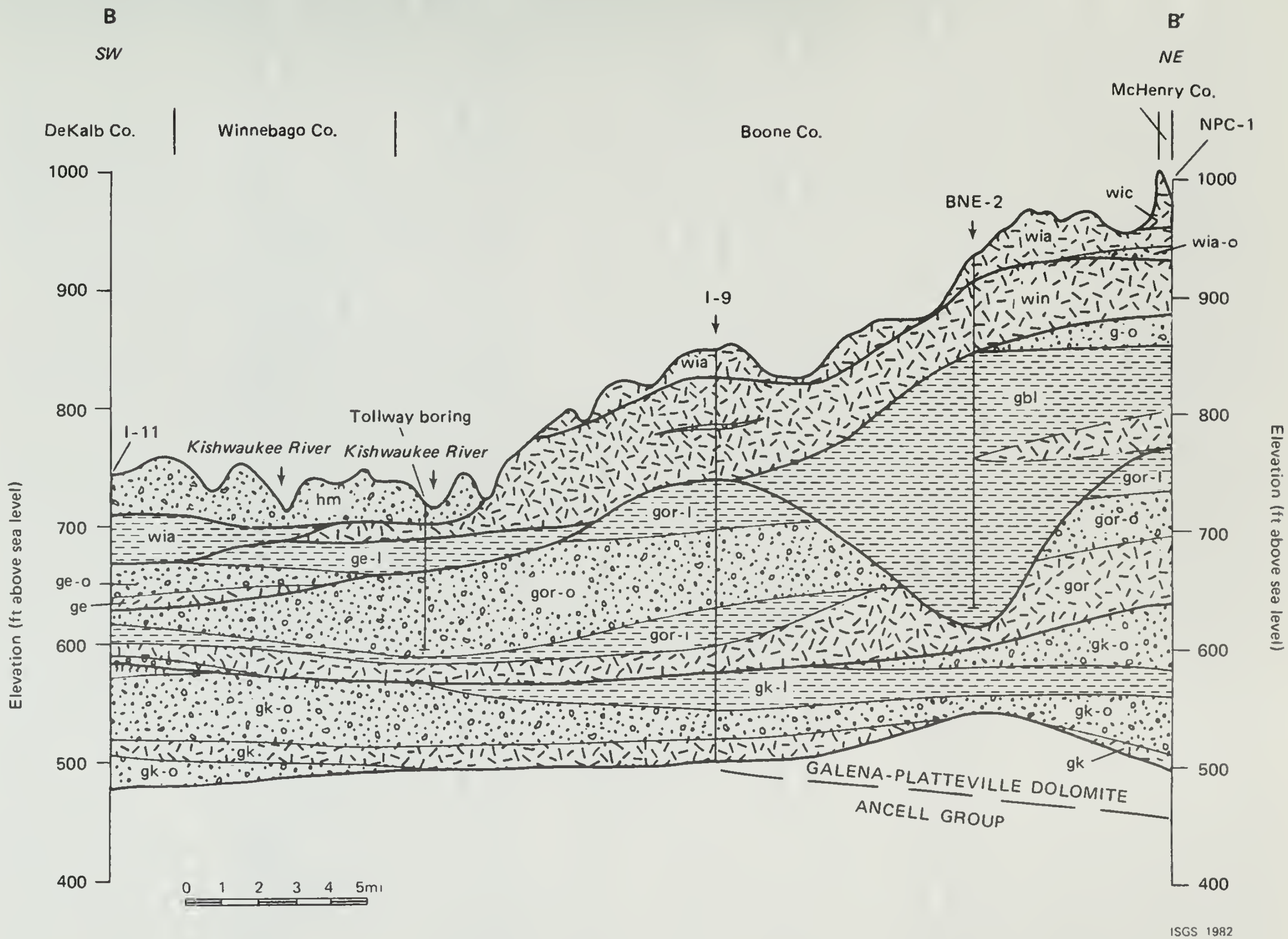


FIGURE 6. Southwest-northeast cross section along lowest part of Troy Bedrock Valley from northern De Kalb County to northwest McHenry County.

dust from the floodplains of glacial rivers. The Mississippi and Illinois River floodplains were primary sources. The Rock River floodplain apparently was a local source. Loess (up to 9 feet) is thickest on the uplands in northern Boone County, on the west side of the Rock River Valley in Winnebago County, and in the Kishwaukee River-Piscasaw Creek Valleys. It has been eroded away in southern Boone County, in extreme southeastern Winnebago County, and adjacent to the east side of the Rock River Valley also in Winnebago County.

Windblown or eolian sand overlies outwash sand and gravel on terraces of the Rock and Kishwaukee Rivers. It also occurs fairly extensively east of the Rock River valley, where it has blown up onto the uplands primarily through small drainageways.

Although the study of geologic history tells us something of the environmental conditions that existed prior to the written record, the primary use of geology today is serving the everyday needs of people. A geologic study showing some of these aspects was recently completed and is currently available in county offices. Titled "Geology for Planning in Boone and Winnebago Counties," the report explores how the knowledge of geologic conditions and limitations of geologic materials can assist in planning for activities such as location and utilization of groundwater resources, siting of proposed landfills, selection of areas in which septic systems would function optimumly, and exploration and development of mineral resources.

It is generally recognized that Boone and Winnebago Counties have abundant water resources. However, the same geologic conditions that dictate the availability of groundwater also control the sensitivity of an area to potential groundwater (and surface water) contamination from improper or intensive waste disposal practices and overapplication of agricultural chemicals. Therefore, in areas of the state where groundwater availability is a serious problem, the geologic conditions are frequently suitable for at least some types of waste disposal with little or no fear of groundwater contamination. In Boone and Winnebago Counties, potential contamination of groundwater is a serious problem because of the presence of shallow, water-yielding materials which may allow rapid infiltration of contaminants.

1 Discussion of geologic conditions that helped form the fen southeast of the railroad. (NE¼ NW¼ SE¼ Sec. 16, T. 45 N., R. 4 E., 3rd P.M.; Boone County; Belvidere NE 7.5-minute Quadrangle)

About 500 feet southeast of the northeasterly trending railroad tracks is a mound of highly decomposed, fine-textured organic matter (sapric peat) called a raised fen. In the Fox River valley and in other parts of northeastern Illinois fens are quite common; however, none has been described in Boone or Winnebago Counties. The decomposition of organic matter here is controlled by moisture content, temperature, type of organic parent materials, acidity, microbial activity, and time.

All other fens studied in northeastern Illinois have a constant supply of cold alkaline groundwater throughout the year. Beneath the fens is usually found sand and gravel with a high potential for transmitting the constant groundwater supply. High-carbonate minerals in underlying outwash and till deposits and in the dolomite bedrock are important sources of calcium and magnesium, and account for alkaline pH values of between 6.9 and 8.2 for the peat.

The fen is about 5 feet higher than the surrounding area; apparently the peat accumulates upward because of the constant supply of groundwater being forced up through the peat. In some areas fens have been reported up to 20 feet high. As you look in all directions from STOP 1, note that the fen is near the center of a basin, completely surrounded by uplands. This basin is actually the headwaters (origin) of Beaver Creek. The location of the fen is a discharge point of groundwater flowing from these uplands.

The unusual hydrogeological conditions in the fen result in a rather unique assemblage of prairie plants more typical of colder regions than of northern Illinois. Many characteristic Illinois prairie grasses can be seen. Clumps of big blue stem (Andropogon gerardii) and little blue stem (Schizachyrium scoparium) dominate. Fen thistle (Cirsium muticum), Kalm's lobelia (Lobelia kalmii), grass of Parnassas (Parnassia glauca), and Ohio goldenrod (Solidago ohioensis) are also common. Floras of fens characteristically include relic species (25 have been identified in northeastern Illinois). Apparently the unique environmental condition of cold calcareous groundwater percolating through peat has remained relatively constant through time, providing a refuge for colder-weather floral species that could not survive on the surrounding uplands when conditions warmed up following deglaciation. An effort is being made in Illinois to preserve these unique geologic and vegetative habitats.

2 Discussion of terrace levels along Piscasaw Creek. (SE¼ SW¼ NW¼ NE¼ Sec. 7, T. 44 N., R. 4 E., 3rd P.M., Boone County; Belvidere North 7.5-minute Quadrangle)

As we turned east onto Woodstock Road over Russelville Road, we were on an upper terrace of Piscasaw Creek; proceeding eastward, we descended this terrace

onto a lower terrace adjacent to the present Piscasaw Creek. STOP 2 is located at the terrace break between the upper and lower terraces west of the creek. These upper and lower terraces of Piscasaw Creek (and the Kishwaukee River as well) were formed during the melting of younger glaciers to the east. Each terrace elevation suggests a depositional episode during which sand and gravel was laid down in the valley. The upper terrace is the older of the two and probably formed as the Tiskilwa Till on the Marengo Ridge was being deposited just to the east of Boone County, almost 20,000 years ago. The Marengo Ridge is quite visible from numerous places in Boone County (the moraine goes roughly north-south through the town of Marengo). South of this point the moraine trends southwesterly. This moraine marks the extent of the Woodfordian ice into Illinois.

As the climate warmed and the glacier started melting, massive amounts of meltwater flowed down the Kishwaukee River and Piscasaw Creek. Along Russelville Road the valley of Piscasaw Creek is about two miles wide. During maximum melting this entire valley was undoubtedly filled with rapidly flowing water. Moving with the water were large volumes of outwash sediment that melted out of the glacier. Sand and gravel of the Henry Formation, Mackinaw Member comprise this outwash. As water velocities decreased and could no longer transport the sand and gravel, outwash material was deposited in a rather flat plain bounded on either side by the valley walls. The upper terrace consists of this outwash material.

The lower terrace probably formed at a later date (around 16,000 years ago) as ice melted from the moraines to the east and north of Marengo Ridge. The lower terrace was formed when part of the upper terrace was eroded. There seems to have been less meltwater from these later glaciers than from the previous event that formed Marengo Ridge; otherwise, the entire upper terrace would have been eroded. Within the entire Kishwaukee River-Piscasaw Creek Valley, the upper terrace is by far the most extensive of the two terraces.

The maximum thickness of the sand and gravel deposits in the Kishwaukee River and Piscasaw Creek is about 120 feet. In the vicinity of Belvidere, sand and gravel deposits are less than 50 feet thick; adjacent to valley walls, deposits are less than 20 feet thick. Terraces are composed of medium to very coarse sand, usually with less gravel than is found in the Rock River valley. The upper terrace usually has more than 3 feet of windblown sand above the sand and gravel terrace deposits, and the lower terrace has more than 3 feet of silt. The silt may be windblown loess or may be the result of modern alluviation.

The flat topography of the river valley, its good drainage (due to the sand and gravel substratum), and its finer-grained, often organic-rich overburden make this one of the best farming regions in the area.

3 Discussion of Winnebago Formation till members and the underlying dolomite of the Ordovician Galena Group. (NW¼ NW¼ NW¼ SW¼ Sec. 19, T. 44 N., R. 3 E., 3rd P.M., Boone County; Caledonia 7.5-minute Quadrangle)

This section of till and outwash suggests that this area was relatively close to the ice front. Two tills have been identified here. In the northeastern corner of the quarry is an exposure of 10 feet of till underlain by distorted beds of sand and gravel outwash. The upper 5 feet of till has been identified as the Argyle Till Member of the Winnebago Formation. The underlying till has been identified as the Nimtz Till Member, also of the Winnebago Formation. Both of these tills are found almost everywhere in northern Boone County and northeastern and eastern Winnebago County. The Rock River valley appears to be the western extent of the Nimtz Till, while the Argyle Till extends into central Winnebago County. The Kishwaukee River is the southern boundary for both of these units.

The till at the stop also has a recognizable platy structure. Because of the tremendous weight of the ice, the till at the base of the glacier was compressed and became very hard, which explains the bedding-like structural appearance of the till. It appears that the lower till, which is the Nimtz Till, overrode the outwash and probably was the primary cause for the distortion of the sand and gravel. Parts of the till are found completely within the underlying outwash, surrounded by sand and gravel beds lying at 90^{o} angles. These inclusions are referred to as till balls.

The bedrock being quarried here is dolomite of the Galena Group. A detailed description of this rock will be presented in the discussion of STOP 9.

Since there are at least 12 glacial tills identified in the Capron-Rockford area (fig. 4), it is reasonable to assume that glaciers covered all or part of the areas at least 12 different times. Although each of the tills has some characteristics that have aided in identification, several are very similar, which has made identification difficult until recently.

The particular composition of tills results from (1) the materials incorporated into glacial ice as it crossed over a particular land surface, (2) the distance the materials have been transported, and (3) the nature of the topography beneath the ice. Because tills display unique and relatively uniform compositions, they are the most predictable of glacial materials and, therefore, the basic unit for geologic mapping. The tracing of a till from one locale to the next is accomplished by studying its physical attributes—the percentage of sand, silt and clay, type and amount of clay minerals present, and relative amounts of calcite and dolomite.

Data for two samples from each till (table 1) illustrate how these parameters can be used for defining tills.

Although the two tills may look alike, laboratory data show that they are quite distinct. The Nimtz Till is slightly more sandy, but the percentage of illite is significantly greater. These higher illite values characteristically separate the Nimtz from the Argyle throughout the region.

TABLE 1. Representative data from till samples.

	a	b			c			d		
	Gravel	Sand	Till	Clay	Ex	I	K+C	Cal	Dol	
RCB 7-1-1-	12	46	32	22	28	61	12	55	63	
7-1-2	9	53	29	18	26	65	9	41	53	Argyle Till
7-2-1	21	53	31	16	18	72	11	45	51	
7-2-2	12	54	31	15	21	69	10	34	45	Nimtz Till

GRAIN-SIZE ANALYSIS
a Gravel (%) in total sample
b Sand, silt, and clay (%) in less-than-2 mm fraction of sample (totals 100%)

X-RAY DIFFRACTION ANALYSIS
c Clay mineral analysis (totals 100%): Ex=expandable clay minerals (%); I=illite (%); K+C=kaolinite and chlorite (%)
d Counts/second of calcite and dolomite

Explanation of the Analyses - A grain-size analysis is performed by sieving a soil sample and measuring the relative quantities of gravel, sand, silt, and clay in it. The silt and clay separation is determined by hydrometer analysis. An X-ray diffraction analysis (columns a and b), which determines the relative amounts and kinds of clay and carbonate minerals in a sample, is made by rotating a sample in an X-ray beam and recording the various intensities of radiation reflected by the sample during its rotation. The results of these analyses can be used to identify the layers of drift deposited by different glaciers if the deposits of each glacier prove to have a regionally distinctive, recognizable grain-size and mineral composition. Such is often the case, because each flowing glacier ground the rock and earth it picked up into a very homogeneous mixture and because the glaciers that flowed into the state came from several different directions and moved over different materials. Therefore, in small regions composed of several counties the grain size and mineral composition of a particular till will often be consistent.

4

Discussion of bedrock exposure of the Ordovician Maquoketa Group in low roadcut on east side of Stone Quarry Road. (W edge NW¼ SW¼ SW¼ NW¼ Sec. 14, T. 43 N., R. 3 E., 3rd P.M., Boone County; Belvidere South 7.5-minute Quadrangle)

On the east side of Stone Quarry Road is a bedrock exposure of the Brainard Formation of the Maquoketa Group. It is a greenish shale with dolomite stringers. The dolomite is light yellowish-brown, very fine grained, and very fossiliferous. This is the best fossil collecting stop of the field trip; brachiopods can often be found here.

Rocks of the Maquoketa Group constitute the surficial bedrock in southeastern Boone County, and in isolated places in northern and western Boone County (fig. 2). The Maquoketa is generally about 50 feet thick in Boone County; however, thicknesses of more than 200 feet are reported in neighboring counties. A deep well just to the east of the exposure at STOP 4 reveals a small remnant of Silurian dolomite 16 feet thick at the top of the hill. A small quarry here extracted this dolomite. Beneath the Silurian dolomite is

115 feet of Maquoketa rocks, the thickest accumulation of these rocks in Boone County, underlain by 359 feet of dolomite of the Galena and Platteville Groups. The bottom of this well is in the St. Peter Sandstone.

Because the shale is very compact, the Maquoketa is not considered a reliable groundwater source, although small supplies of water are obtained in some places. The Maquoketa shale, where present, is a hydrogeological barrier between the surface and deeper, water-yielding formations. Under most conditions, landfills can be located over this shale because it is unlikely that contaminants will penetrate its impervious strata.

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5 **Discussion of Esmond Till exposed along both sides of roadcut. (E edge NE¼ NE¼ SE¼ NE¼ Sec. 28, T. 43 N., R. 2 E., 3rd P.M., Winnebago County; Cherry Valley 7.5-minute Quadrangle)**

Brownish-gray silty clay Esmond Till is exposed in road cuts on both sides on Mulford Road. The till is 14 percent sand, 41 percent silt, and 45 percent clay. The clay minerals are characterized by their exceptionally high illite content (75%). This till can be easily identified and traced in this part of Illinois by its grain size and clay mineral composition.

The age of the Esmond has only recently been resolved (fig. 4). The Esmond was previously considered the oldest till of Woodfordian age, which means that it could not be older than about 22,000 years; therefore, the sandy Winnebago Formation tills (including the Argyle and Nimtz Tills) had to be older than the Esmond. Data generally supported that conclusion; sandy tills in northern Boone County were essentially identical in color, texture, and clay mineralogy to those tills underlying the Esmond in Lee and Ogle Counties. In addition, the Esmond had a 'youthful' appearance: old buried soils were absent and the topography of the Esmond surface appeared sharp and rugged . However, it is now fairly clear that the youthful appearance of the Esmond and the general lack of old, buried soils in the area of the Esmond were the results of extreme erosion, probably about the same time as terraces were cut along the Kishwaukee River and Piscasaw Creek. Two recent (1981) radiocarbon dates on organic silt below the Esmond in northeastern Ogle County show that the till is more than 41,000 years old; therefore, the Esmond Till is not Wisconsinan in age, but probably an Illinoian-age till older than 75,000 years.

This recent discovery, which at least partly resolves the Esmond problem, also means that the sandy tills below the Esmond in portions of southern Boone, Ogle, and Lee Counties cannot be the same as those of northern Boone County, which have been shown to overlie the Esmond. The upper sandy tills are being retained as Winnebago Formation units, and the lower till has been renamed the "Oregon Till Member."

Further subdivision of the Winnebago Formation reveals four separate tills: the Nimtz and Argyle, discussed earlier, overlain by the Clinton and Capron Tills in extreme northern and northeastern Boone County. The recognition of these units and their separation from the Oregon Till by the Esmond Till led to a significant reorganization of the stratigraphic succession.

The Esmond Till, like the Maquoketa shale, is a fine grained material containing much clay and silt; therefore, it has a high attenuation capacity—an ability of that material to remove contaminants from the water passing through the material. Clay particles can capture certain pollutants as they flow downward through the material and then release calcium or sodium in its place. The result of this natural filtering process is a purification of the groundwater from certain contaminants.

Because of the attenuation capacity of their clays, areas over thick Esmond Till or Maquoketa Shale are optimum areas for landfill sites. However, these materials are quite cohesive and often retain water longer than sandy materials do. Therefore, construction at and maintenance of a site may be a problem.

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6 **Discussion of drainage changes as related to the bedrock of the field trip area. (SE¼ NE¼ NE¼ NE¼ Sec. 21, T. 43 N., R. 2 E., 3rd P.M., Winnebago County; Cherry Valley 7.5-minute Quadrangle)**

As glaciers moved into southern Boone and Winnebago Counties from the south and stagnated, the total drainage pattern of the region changed markedly. Meltwater from the east previously flowed down the now buried Troy Bedrock Valley. As this river became blocked by glacial ice, meltwater was diverted to the west across a dolomite ridge. The major concentration of flow cut the narrow 150-foot deep gorge through which the present Kishwaukee River flows. A bedrock bench at about 720 feet in elevation at the mouth of the gorge marks the lowest point of downcutting by the outwash flow. The modern river has cut about 10 feet below this bench.

A secondary smaller gorge is located on the western slope of the upland ridge about one mile north of the Kishwaukee Gorge. A broad depression filled with stratified sand connects the valley of this gorge with a narrow easterly-grading stream valley on the eastern slope of the upland. Meltwater flow probably was responsible for the cutting of this gorge.

It was previously thought that the event causing the excavation of the gorge occurred early in Wisconsinan time, and that the glacier that deposited the Esmond Till was primarily responsible for blocking the drainageways and creating river diversions. But because we now know that the Esmond event occurred considerably earlier than previously thought, the exact time that the gorge was cut is less well understood.

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7 **Discussion of internal structure and occurrence of glacial kames. (E½ NE¼ NE¼ Sec. 22, T. 43 N., R. 2 E., 3rd P.M., Winnebago County; Cherry Valley 7.5-minute Quadrangle)**

At this stop we have the rare opportunity to see the internal structure on all sides of a glacial feature termed a kame. Kames are moundlike hills of sand and gravel, often called ice-contact deposits because the material was deposited in direct contact with glacial ice. Kames originated as bodies of

sediment were deposited in crevasses and other openings in or on the surface of stagnant ice. The ice gradually melted away, leaving accumulations of sediment in the form of isolated or semi-isolated mounds (fig. 7). Layers are often distorted and almost at right angles to the ground surface because ice within the sediment melted, allowing the sediment to collapse. The sand and gravel deposits at STOP 3 also show this phenomenon; they probably represent a buried kame-like deposit.

The kame at STOP 7 and the kame 1½ miles to the east on Blomberg Road just west of the South Branch Kishwaukee River (see road log) are isolated mounds of sand and gravel that probably accumulated in the deeper parts of rivers that flowed on the surface of the ice. A northwesterly-trending short ridge between Wheeler Road and Irene Road (north of Flora Church Road) is a type of kame referred to as a crevasse filling. When elongated and sinuous, these ridges are called eskers. The only esker in the area crosses Steward Road east of its intersection with Tate Road, two miles southeast of Harrison in north-central Winnebago County.

Kame deposits are usually quite variable in their sand and gravel content; their particle-size characteristics often change within relatively short distances and depths. Kames sometimes contain masses of till, silt, and clay along with some bodies that are primarily sand and others that are primarily coarse gravel. Most deposits here are more than 20 feet thick, but are not known to exceed 80 feet. Kames have long been an important local source of sand and gravel (especially in the more rural areas), but they have no potential as a long-term source because of their limited areal extent and variability. Bedrock quarries have been located at several places in southern Boone and southeastern Winnebago Counties where the sand and gravel deposits are particularly thin.

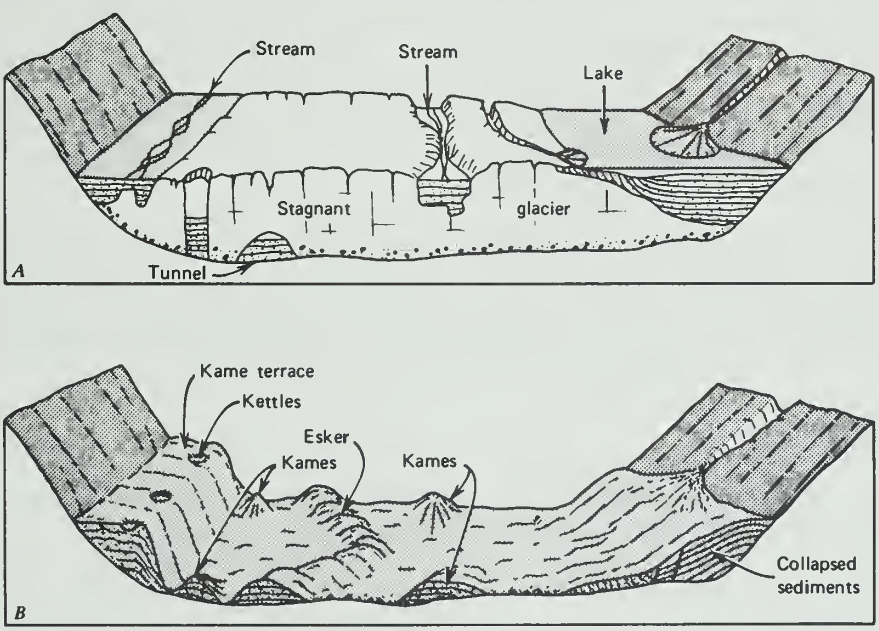

FIGURE 7. Origin of kames: (A) Stagnant glacier ice affords temporary retaining walls for bodies of sediment built by streams and in lakes; (B) As ice melts, bodies of sediment are let down and are deformed in the process. (From Flint, R. F., 1971, Glacial and Quaternary Geology, published by John Wiley and Sons, Inc., New York, p. 209.)

8 **Discussion of Rockford Terrace gravels and ice-contact features. Entrance to property. (SW¼ SW¼ SE¼ SE¼ Sec. 4, T. 43 N., R. 1 E., 3rd P.M., Winnebago County; Rockford South 7.5-minute Quadrangle)**

North of Simpson Road is a sand and gravel operation where materials from a feature termed the Rockford Terrace are excavated. This feature was previously thought to represent an upper terrace of the Rock River; now it is considered a type of kame—a kame terrace. Kame terraces are accumulations of sand and gravel laid down primarily by streams flowing between a glacier and the side of a valley. When the glacier melted, a constructional terrace was left (fig. 7). Since this feature at STOP 8 lies against the west valley wall of the Rock River, it is quite possible that a glacier could have been trapped in the valley and, upon melting, formed this kame terrace. The large boulders at the site attest to a closeness of the ice front, since it is difficult to move boulders of this size great distances by river transport. This is an excellent collecting location for many varieties of rocks and minerals.

The glacier responsible for this feature probably crossed over the landscape during Illinoian time. A thick soil, presumably the Sangamon Soil, is found above the gravels. The Sangamon Soil formed in the major interglacial period between the Wisconsinan and Illinoian, about 75,000 to 125,000 years ago.

Also of interest here are indications of ice wedges that once projected into the gravels, and were subsequently filled with sand. These orange, sandy wedges are quite visible along the entire perimeter of the pit. Ice wedges formed during intense cold periods when the soil was completely frozen. The freezing action caused the material to contract, creating frost cracks. During subsequent thaw periods, meltwater filled the cracks and debris (in this case, sand), filled the voids and closed the openings. Freezing occurred again, this time forming cracks within the previously formed wedges, and again with thaw periods, debris filled the void. The process was repeated annually as the ice wedges gradually thickened.

The processes and features described above do not occur in Illinois under present climatic regimes. They could only have developed during glacial times when permanent freezing of the materials to considerable depth took place at regular intervals for an extended period of time. Similar features are forming today in northern North America and Eurasia.

Another feature that may be present in the STOP 8 area is patterned ground. Ice wedges are often interconnected, and when these wedges are viewed from above, the pattern may resemble circles, polygons, nets, or stripes. The loess has been removed from a strip about 30 feet wide above the sand and gravels containing the ice wedges on the east side of the pit. There is some indication that the wedges are interconnected; you may be able to find evidence of this. You may also wish to examine the modern soil that has formed in the loess overlying the sand and gravel. The loess here is about 4 feet thick. Soil-forming processes have segregated the material into recognizable horizons. The A-horizon is the organic-rich zone at the surface, underlain by the B-horizon (where clays removed from the A-horizon have accumulated). The C-

horizon is unaltered loess, which overlies the sand and gravel of the kame terrace. The A-horizon will feel sandier than the other two horizons. The B-horizon is recognizably clayey, while the C-horizon, being composed of loess, will feel silty.

9

Discussion of Ordovician bedrock and Pleistocene glacial tills exposed in the quarry. Office of Nimtz Quarry. (NE¼ SE¼ NE¼ SW¼ Sec. 33, T. 45 N., R. 2 E., 3rd P.M., Winnebago County; Rockford North 7.5-minute Quadrangle)

Dolomites of the Galena Group (fig. 1) and an exceptional Pleistocene exposure above the bedrock can be seen at the Nimtz Quarry. The lower part of the quarry is composed of the Dunleith Formation, the upper 15 to 20 feet of the Wise Lake Formation. The Loves Park Member comprises most of the Dunleith Formation and consists of relatively pure dolomite that lacks argillaceous (clayey) zones. Large chert nodules and bentonite layers are characteristic. The material is not very fossiliferous. A prominent bedding plane near the top of a cherty zone in the Dunleith is the contact with the Wise Lake Formation. Wise Lake dolomite is light brown, very pure, and non-cherty; it contains a wide variety of internal and external molds of fossils. The Wise Lake Formation commonly produces the best aggregate because of the absence of chert. Exploration for the Wise Lake is most likely to be successful in eastern Winnebago and western Boone Counties. The complete geologic section of the bedrock units at STOP 9 is presented in figure 8.

Galena Group		
Wise Lake Formation (36′ 9″)		
Dolomite, pure buff, medium grained, fossiliferous; 8″ to 16″ beds; ½″ to 2″ shaly parting at base possibly position of Dygerts Bentonite Bed	20′	
Dolomite, pure, buff, vuggy; 1′ to 3′ beds; molluscan fossils including *Hormotoma* common in some beds	16′	9″
Dunleith Formation (78′ 7″)		
Wyota Member		
Dolomite, cherty, buff; 4″ to 10″ beds; chert nodules very abundant in upper 8′	14′	
Loves Park Member (type section) (42′ 7″)		
Dolomite; as above but not cherty; 12″ beds; several corrosion surfaces; *Receptaculites*	5′	5″
Dolomite, slightly argillaceous, buff; 4″ to 6″ beds with thin, brown shaly partings; large chert nodules near middle form a nearly continuous bed; small irregular chert nodules near base; 4 corrosion surfaces	5′	2″
Dolomite; as above but not cherty; several corrosion surfaces; *Receptaculites*	6′	
Dolomite, relatively pure, buff, vuggy; 4″ to 6″ beds; 3 prominent corrosion surfaces	4′	2″
Dolomite, slightly argillaceous, buff, dense; in 2 smooth-faced beds	3′	4″
Dolomite; as above but vuggy; rough weathered face; several corrosion surfaces near top	4′	
Dolomite, light buff, dense; prominent 5″ to 8″ smooth-faced beds; upper 1′ cherty; 4 or 5 prominent corrosion surfaces; *Receptaculites*	3′	3″
Dolomite; as above but vuggy	10′	
Dolomite, slightly argillaceous, buff; 1″ to 4″ beds; chert bed near base	1′	3″
Fairplay Member (16′)		
Dolomite, pure, buff, medium grained; 3″ to 4″ beds	4′	4″
Dolomite; as above but contains small brown chert nodules	1′	4″
Dolomite; like 4′ 4″ unit above; 3 corrosion surfaces in upper 5′; *Receptaculites*	10′	4″
Eagle Point Member		
Dolomite, cherty, buff, vuggy; 4″ to 10″ beds	6′	

FIGURE 8. Geologic section of bedrock units at Nimtz Quarry, Harlem Southeast Section, from ISGS Circular 502, page 64.

On the south side of the quarry a prominent contact between the bedrock and the overlying Pleistocene deposits allows us to view a cross section of the bedrock surface. Note the small sag or depression in the bedrock surface, and the variability in drift thickness over short distances. It appears that three very old glacial tills were preserved in this sag, apparently surviving repeated erosion from glaciers originating from the east. The glacial

deposits near the base of the depression possibly date back to pre-Illinoian time (500,000 yrs, B.P.). A silt with wood fragments was discovered here. At least three separate tills are present here in the overlying glacial material, making this possibly the best multi-till exposure found thus far in Winnebago and Boone Counties. In all, five tills have been identified : Argyle, Nimtz, Belvidere, Foxhollow, and Kellerville.

On the north quarry wall, Nimtz Till predominates, with no indication of Argyle Till. Beneath the Nimtz Till along the eastern portion of the north wall, is the Oregon Till (underlying the Esmond Till) which we discussed at Stop 5. Evidence at this stop shows the clear separation of the Argyle and the ne Oregon Tills, which were previously thought of as one till. The Argyle overlies the Nimtz on the south side of the quarry, while the Oregon underlies the Nimtz on the north side. This evidence supports the conclusions discussed at STOP 5.

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PLEISTOCENE GLACIATIONS IN ILLINOIS

Origin of the Glaciers

During the past million years or so, the period of time called the Pleistocene Epoch, most of the northern hemisphere above the 50th parallel has been repeatedly covered by glacial ice. Ice sheets formed in sub-arctic regions four different times and spread outward until they covered the northern parts of Europe and North America. In North America the four glaciations, in order of occurrence from the oldest to the youngest, are called the Nebraskan, Kansan, Illinoian, and Wisconsinan Stages of the Pleistocene Epoch. The limits and times of the ice movement in Illinois are illustrated in the following pages by several figures.

The North American ice sheets developed during periods when the mean annual temperature was perhaps 4° to 7° C (7° to 13° F) cooler than it is now and winter snows did not completely melt during the summers. Because the cooler periods lasted tens of thousands of years, thick masses of snow and ice accumulated to form glaciers. As the ice thickened, the great weight of the ice and snow caused them to flow outward at their margins, often for hundreds of miles. As the ice sheets expanded, the areas in which snow accumulated probably also increased in extent.

Tongues of ice, called lobes, flowed southward from the Canadian centers near Hudson Bay and converged in the central lowland between the Appalachian and Rocky Mountains. There the glaciers made their farthest advances to the south. The sketch below shows several centers of flow, the general directions of flow from the centers, and the southern extent of glaciation. Because Illinois lies entirely in the central lowland, it has been invaded by glaciers from every center.

Effects of Glaciation

Pleistocene glaciers and the waters melting from them changed the landscapes they covered. The glaciers scraped and smeared the landforms they overrode, leveling and filling many of the minor valleys and even some of the larger ones. Moving ice carried colossal amounts of rock and earth, for much of what the glaciers wore off the ground was kneaded into the moving ice and carried along, often for hundreds of miles.

The continual floods released by melting ice entrenched new drainageways, deepened old ones, and then partly refilled both with sediments as great quantities of rock and earth were carried beyond the glacier fronts. According to some estimates, the amount of water drawn from the sea and changed into ice during a glaciation was probably enough to lower sea level more than 300 feet below present level. Consequently, the melting of a continental ice sheet provided a tremendous volume of water that eroded and transported sediments.

In most of Illinois, then, glacial and meltwater deposits buried the old rock-ribbed, low, hill-and-valley terrain and created the flatter landforms of our prairies. The mantle of soil material and the deposits of gravel, sand, and clay left by the glaciers over about 90 percent of the state have been of incalculable value to Illinois residents.

Glacial Deposits

The deposits of earth and rock materials moved by a glacier and deposited in the area once covered by the glacier are collectively called drift. Drift that is ice-laid is called till. Water-laid drift is called outwash.

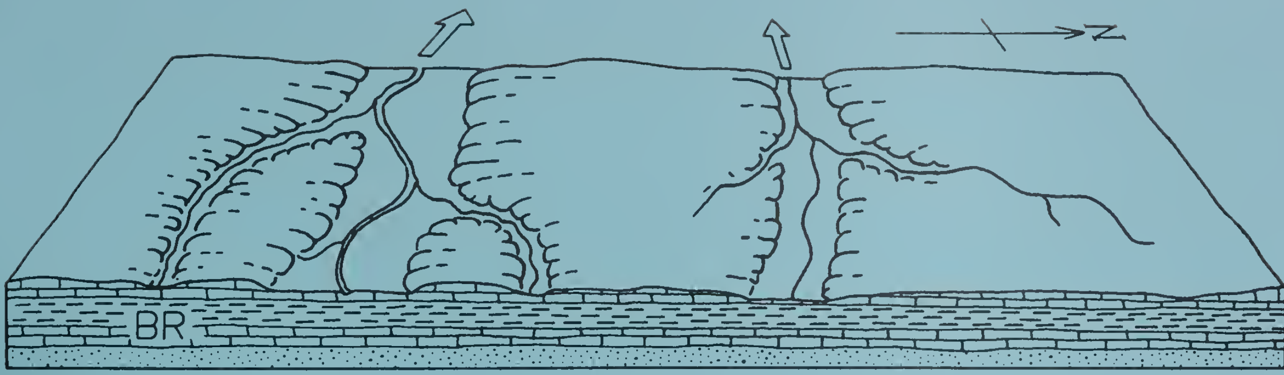
Till is deposited when a glacier melts and the rock material it carries is dropped. Because this sediment is not moved much by water, a till is unsorted, containing particles of different sizes and compositions. It is also unstratified (unlayered). A till may contain materials ranging in size from microscopic clay particles to large boulders. Most tills in Illinois are pebbly clays with only a few boulders.

Tills may be deposited as end moraines, the arc-shaped ridges that pile up along the glacier edges where the flowing ice is melting as fast as it moves forward. Till also may be deposited as ground moraines, or till plains, which are gently undulating sheets deposited when the ice front melts back, or retreats. Deposits of till identify areas once covered by glaciers. Northeastern Illinois has many alternating ridges and plains, which are the succession of end moraines and till plains deposited by the Wisconsinan glacier.

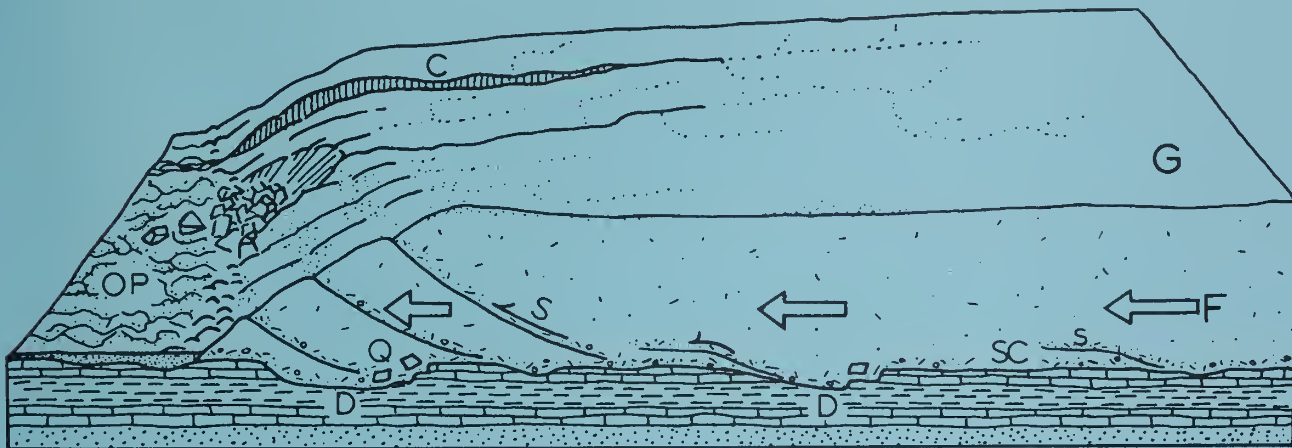
Sorted and stratified sediment deposited by water melting from the glacier is called outwash. Outwash is bedded, or layered, because the flow of water that deposited it varied in gradient, volume, velocity, and direction. As a meltwater stream washes the rock materials along, it sorts them by size--the fine sands, silts, and clays are carried farther downstream than the coarser gravels and cobbles. Typical Pleistocene outwash in Illinois is in multilayered beds of clays, silts, sands, and gravels that look much like modern stream deposits.

Outwash deposits are found not only in the area covered by the ice field but sometimes far beyond it. Meltwater streams ran off the top of the glacier, in crevices in the ice, and under the ice. In some places, the cobble-gravel-sand filling of the bed of a stream that flowed in the ice is preserved as a sinuous ridge called an esker. Cone-shaped mounds of coarse outwash, called kames, were formed where meltwater plunged through crevasses in the ice or into ponds along the edge of the glacier.

The finest outwash sediments, the clays and silts, formed bedded deposits in the ponds and lakes that filled glacier-dammed stream valleys, the sags of the till plains, and some low, moraine-diked till plains. Meltwater streams that entered a lake quickly lost speed and almost immediately dropped the sands and gravels they carried, forming deltas at the edge of the lake. Very fine sand and silts were moved across the lake bottom by wind-generated



1. <u>The Region Before Glaciation</u> - Like most of Illinois, the region illustrated is underlain by almost flat-lying beds of sedimentary rocks--layers of sandstone ( ), limestone ( ), and shale ( ). Millions of years of erosion have planed down the bedrock (BR), creating a terrain of low uplands and shallow valleys. A residual soil weathered from local rock debris covers the area but is too thin to be shown in the drawing. The streams illustrated here flow westward and the one on the right flows into the other at a point beyond the diagram.



2. <u>The Glacier Advances Southward</u> - As the glacier (G) spreads out from its snowfield, it scours (SC) the soil and rock surface and quarries (Q)--pushes and plucks up--chunks of bedrock. These materials are mixed into the ice and make up the glacier's "load." Where roughnesses in the terrain slow or stop flow (F), the ice "current" slides up over the blocked ice on innumerable shear planes (S). Shearing mixes the load very thoroughly. As the glacier spreads, long cracks called "crevasses" (C) open parallel to the direction of ice flow. The glacier melts as it flows forward, and its meltwater erodes the terrain in front of the ice, deepening (D) some old valleys before the ice covers them. Meltwater washes away some of the load freed by melting and deposits it on the outwash plain (OP). The advancing glacier overrides its outwash and in places scours much of it up again. The glacier may be 5000 or so feet thick , except near its margin. Its ice front advances perhaps as much as a third of a mile per year.

currents, and the clays, which stayed in suspension longest, slowly settled out and accumulated with them.

Along the ice front, meltwater ran off in innumerable shifting and short-lived streams that laid down a broad, flat blanket of outwash that formed an outwash plain. Outwash was also carried away from the glacier in valleys cut by floods of meltwater. The Mississippi, Illinois, and Ohio Rivers occupy valleys that were major channels for meltwaters and were greatly widened and deepened during times of the greatest meltwater floods. When the floods waned, these valleys were partly filled with outwash far beyond the ice margins. Such outwash deposits, largely sand and gravel, are known as valley trains. Valley trains may be both extensive and thick deposits. For instance, the long valley train of the Mississippi Valley is locally as much as 200 feet thick.

Loess and Soils

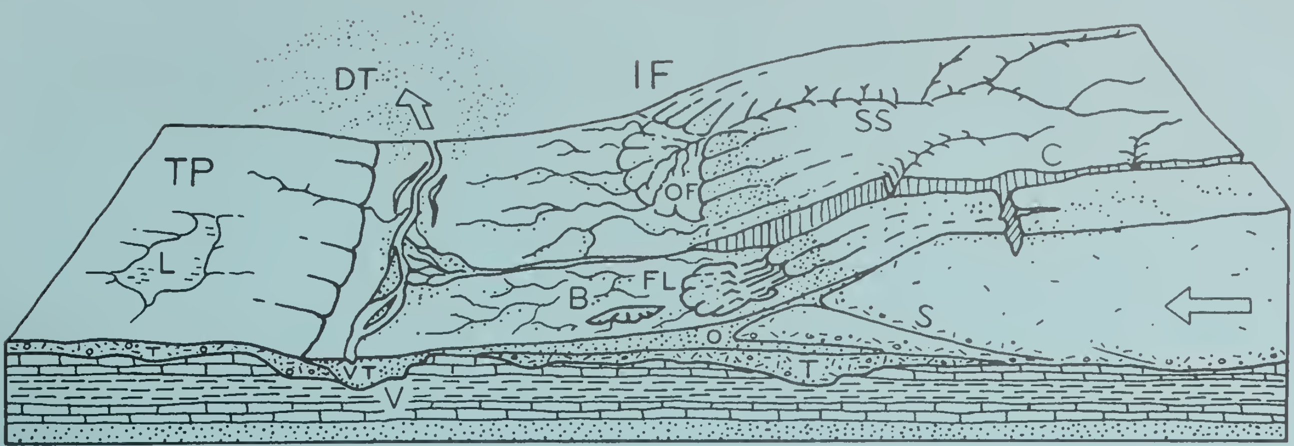
One of the most widespread sediments resulting from glaciation was carried not by ice or water but by wind. Loess is the name given to such deposits of windblown silt and clay. The silt was blown from the valley trains on the floodplains. Most loess deposition occurred in the fall and winter seasons when low temperatures caused meltwater floods to abate, exposing the surfaces of the valley trains and permitting them to dry out. During Pleistocene time, as now, west winds prevailed, and the loess deposits are thickest on the east sides of the source valleys. The loess thins rapidly away from the valleys but extends over almost all the state.

Each Pleistocene glaciation was followed by an interglacial stage that began when the climate warmed enough to melt the glaciers and their snowfields. During these warmer intervals, when the climate was similar to that of today, drift and loess surfaces were exposed to weather and the activities of living things. Consequently, over most of the glaciated terrain, soils developed on the Pleistocene deposits and altered their composition, color, and texture. Such soils were generally destroyed by later glacial advances, but those that survive serve as keys to the identity of the beds and are evidence of the passage of a long interval of time.

Glaciation in a Small Illinois Region

The following diagrams show how a continental ice sheet might have looked as it moved across a small region in Illinois. They illustrate how it could change the old terrain and create a landscape like the one we live on. To visualize how these glaciers looked, geologists study the landforms and materials left in the glaciated regions and also the present-day mountain glaciers and polar ice caps.

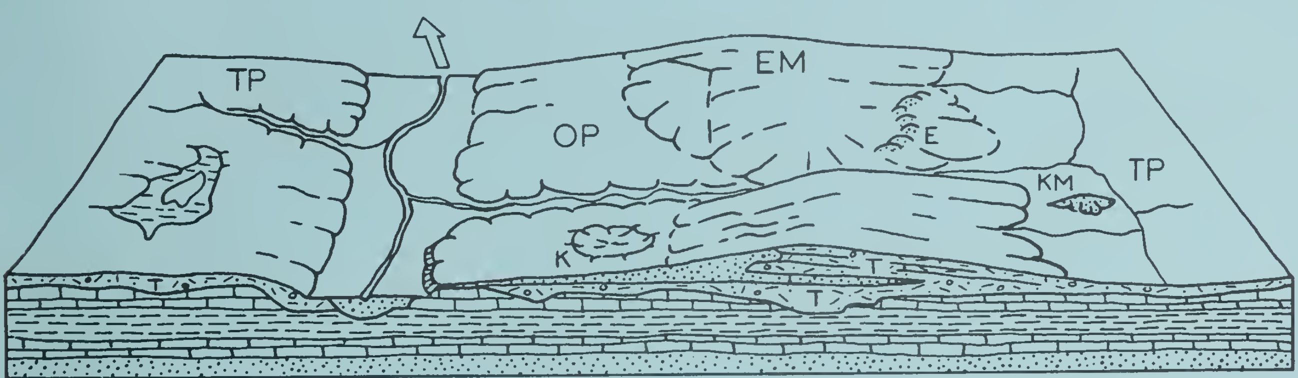
The block of land in the diagrams is several miles wide and about 10 miles long. The vertical scale is exaggerated--layers of material are drawn thicker and landforms higher than they ought to be so that they can be easily seen.



3. <u>The Glacier Deposits an End Moraine</u> - After the glacier advanced across the area, the climate warmed and the ice began to melt as fast as it advanced. The ice front (IF) is now stationary, or fluctuating in a narrow area, and the glacier is depositing an end moraine.

As the top of the glacier melts, some of the sediment that was mixed in the ice accumulates on top of the glacier. Some is carried by meltwater onto the sloping ice front (IF) and out onto the plain beyond. Some of the debris slips down the ice front in a mudflow (FL). Meltwater runs through the ice in a crevasse (C). A superglacial stream (SS) drains the top of the ice, forming an outwash fan (OF). Moving ice has overridden an immobile part of the front on a shear plane (S). All but the top of a block of ice (B) is buried by outwash (O).

Sediment from the melted ice of the previous advance (figure 2) was left as a till layer (T), part of which forms the till plain (TP). A shallow, marshy lake (L) fills a low place in the plain. Although largely filled with drift, the valley (V) remained a low spot in the terrain. As soon as its ice cover melted, meltwater drained down the valley, cutting it deeper. Later, outwash partly refilled the valley--the outwash deposit is called a valley train (VT). Wind blows dust (DT) off the dry floodplain. The dust will form a loess deposit when it settles.



4. <u>The Region after Glaciation</u> - The climate has warmed even more, the whole ice sheet has melted, and the glaciation has ended. The end moraine (EM) is a low, broad ridge between the outwash plain (OP) and till plains (TP). Run-off from rains cuts stream valleys into its slopes. A stream goes through the end moraine along the channel cut by the meltwater that ran out of the crevasse in the glacier.

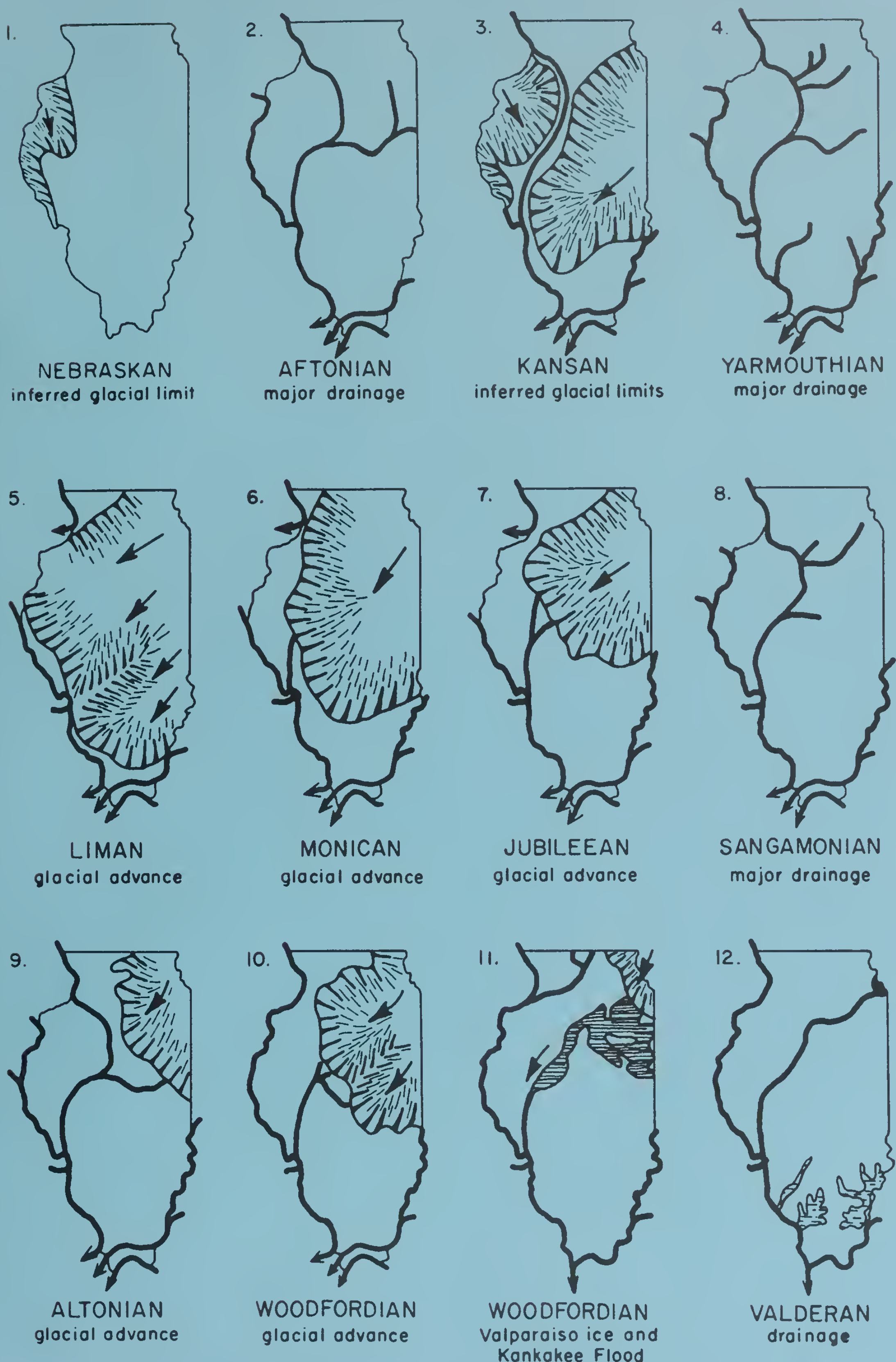
Slopewash and vegetation are filling the shallow lake. The collapse of outwash into the cavity left by the ice block's melting has made a kettle (K). The outwash that filled a tunnel draining under the glacier is preserved in an esker (E). The hill of outwash left where meltwater dumped sand and gravel into a crevasse or other depression in the glacier or at its edge is a kame (KM). A few feet of loess covers the entire area but cannot be shown at this scale.

TIME TABLE OF PLEISTOCENE GLACIATION

STAGE	SUBSTAGE	NATURE OF DEPOSITS	SPECIAL FEATURES
HOLOCENE	Years Before Present	Soil, youthful profile of weathering, lake and river deposits, dunes, peat	
	7,000		
WISCONSINAN (4th glacial)	Valderan	Outwash, lake deposits	Outwash along Mississippi Valley
	11,000		
	Twocreekan	Peat and alluvium	Ice withdrawal, erosion
	12,500		
	Woodfordian	Drift, loess, dunes, lake deposits	Glaciation; building of many moraines as far south as Shelbyville; extensive valley trains, outwash plains, and lakes
	22,000		
	Farmdalian	Soil, silt, and peat	Ice withdrawal, weathering, and erosion
	28,000		
	Altonian	Drift, loess	Glaciation in northern Illinois, valley trains along major rivers
	75,000		
SANGAMONIAN (3rd interglacial)		Soil, mature profile of weathering	
	175,000		
ILLINOIAN (3rd glacial)	Jubileean	Drift, loess	Glaciers from northeast at maximum reached Mississippi River and nearly to southern tip of Illinois
	Monican	Drift, loess	
	Liman	Drift, loess	
	300,000		
YARMOUTHIAN (2nd interglacial)		Soil, mature profile of weathering	
	600,000		
KANSAN (2nd glacial)		Drift, loess	Glaciers from northeast and northwest covered much of state
	700,000		
AFTONIAN (1st interglacial)		Soil, mature profile of weathering	
	900,000		
NEBRASKAN (1st glacial)		Drift	Glaciers from northwest invaded western Illinois
	1,200,000 or more		

(Illinois State Geological Survey, 1973)

SEQUENCE OF GLACIATIONS AND INTERGLACIAL
DRAINAGE IN ILLINOIS



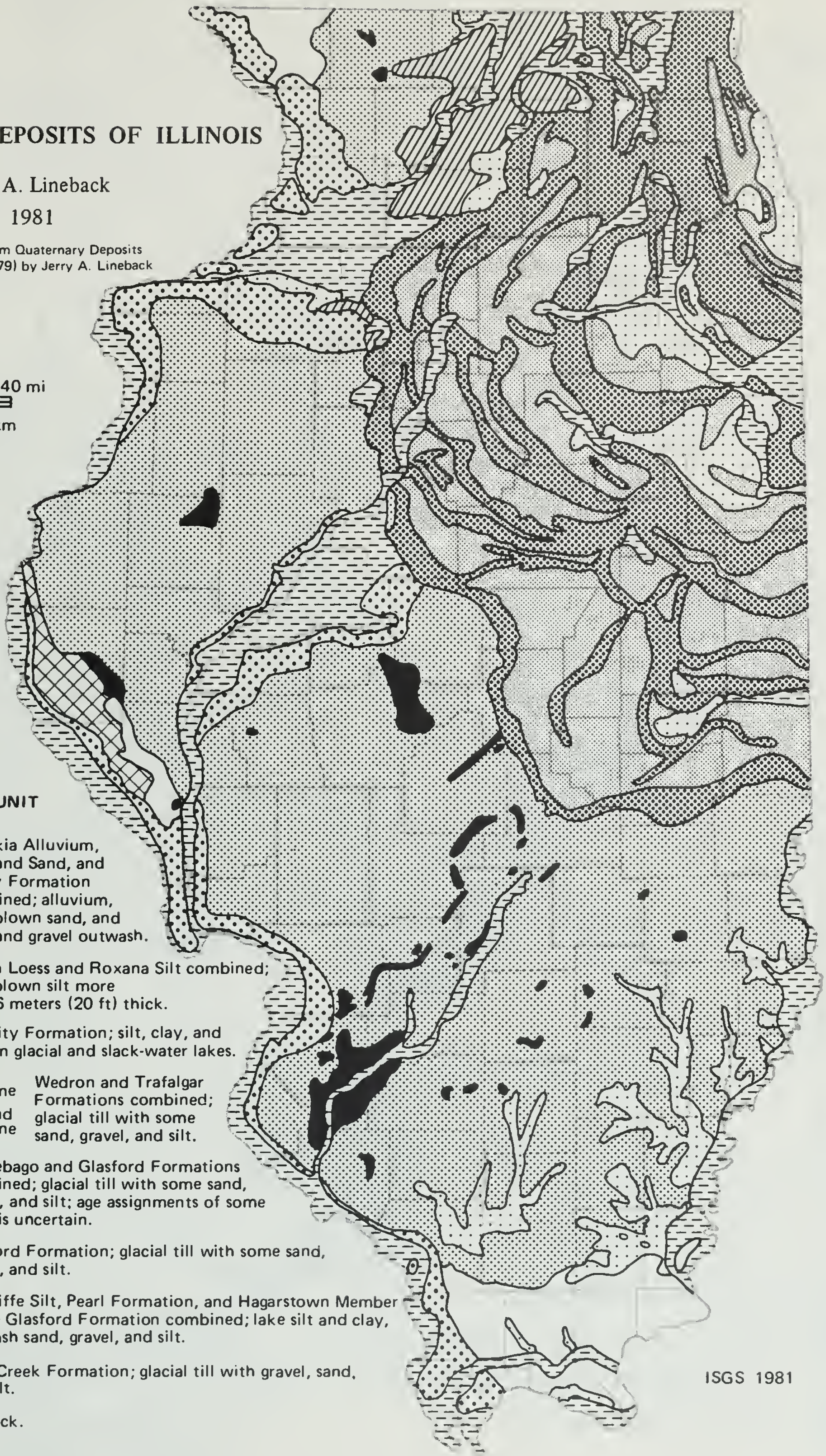
(From Willman and Frye, "Pleistocene Stratigraphy of Illinois," ISGS Bull. 94, fig. 5, 1970.)

QUATERNARY DEPOSITS OF ILLINOIS

Jerry A. Lineback

1981

Modified from Quaternary Deposits of Illinois (1979) by Jerry A. Lineback



0 40 mi

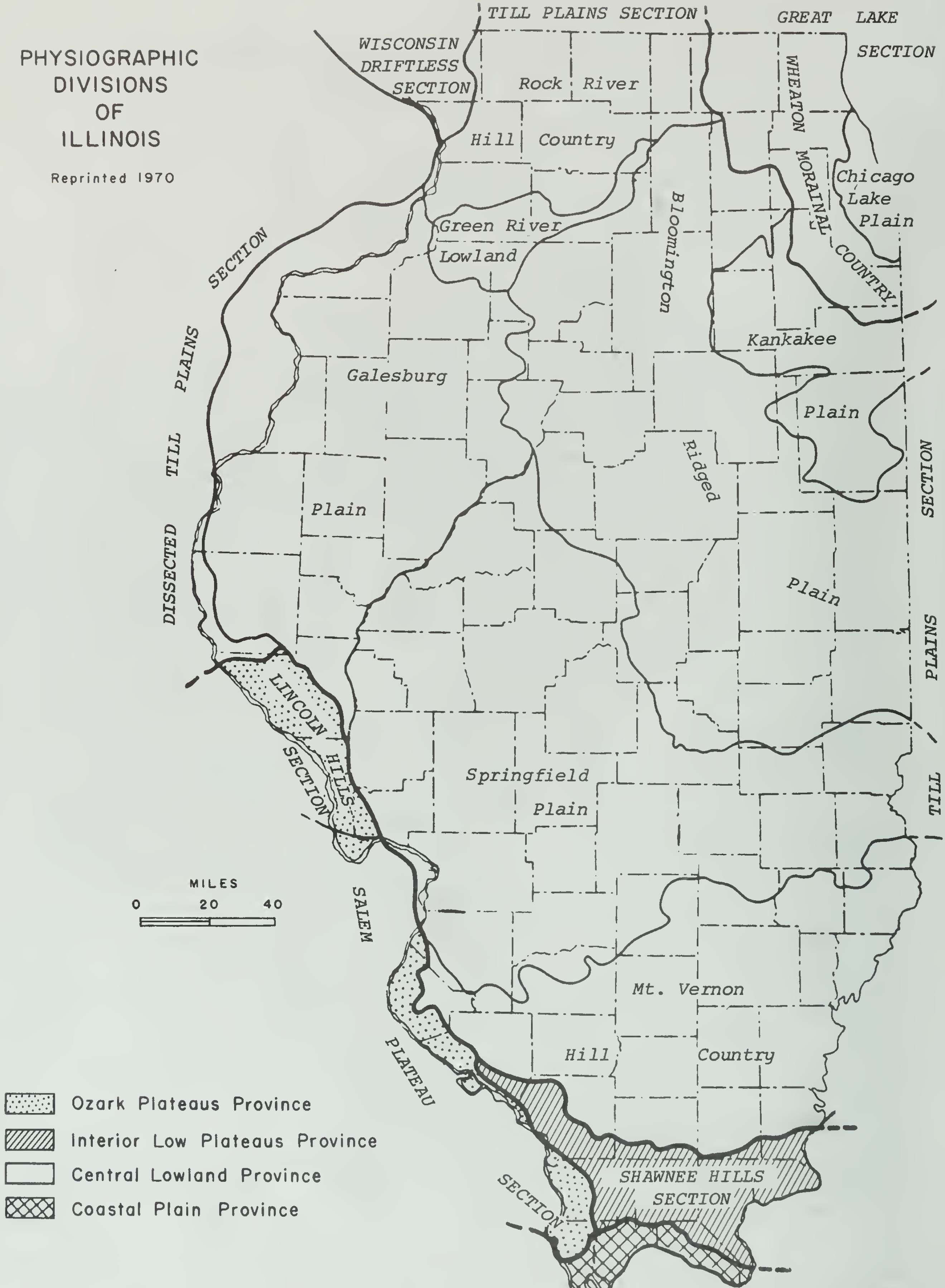
0 50 km

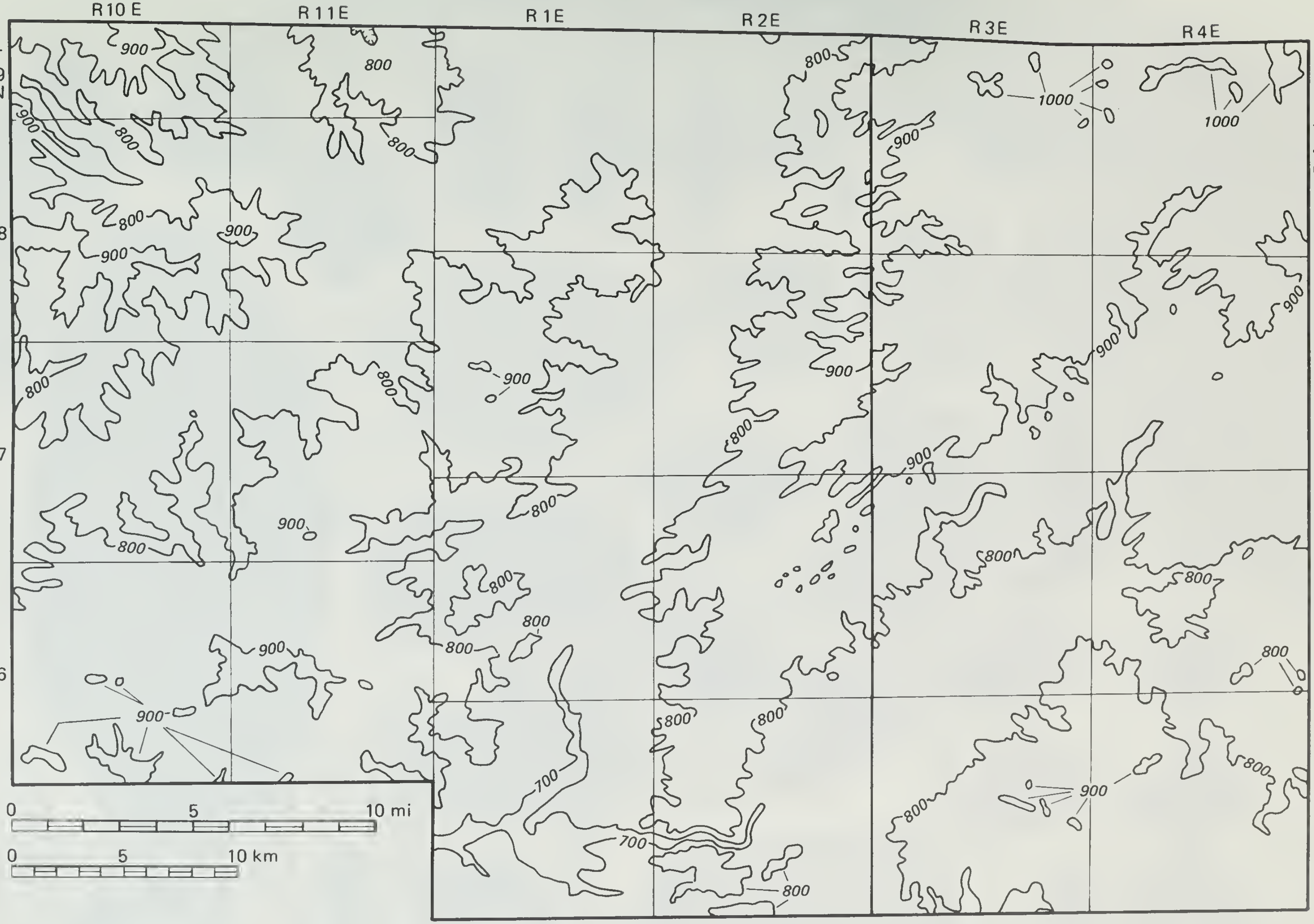
AGE	UNIT
Holocene and Wisconsinan	Cahokia Alluvium, Parkland Sand, and Henry Formation combined; alluvium, windblown sand, and sand and gravel outwash.
Wisconsinan	Peoria Loess and Roxana Silt combined; windblown silt more than 6 meters (20 ft) thick.
	Equality Formation; silt, clay, and sand in glacial and slack-water lakes.
	Moraine / Ground moraine — Wedron and Trafalgar Formations combined; glacial till with some sand, gravel, and silt.
Wisconsinan and Illinoian	Winnebago and Glasford Formations combined; glacial till with some sand, gravel, and silt; age assignments of some units is uncertain.
Illinoian	Glasford Formation; glacial till with some sand, gravel, and silt.
	Teneriffe Silt, Pearl Formation, and Hagarstown Member of the Glasford Formation combined; lake silt and clay, outwash sand, gravel, and silt.
Pre-Illinoian	Wolf Creek Formation; glacial till with gravel, sand, and silt.
	Bedrock.

ISGS 1981

PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

Reprinted 1970

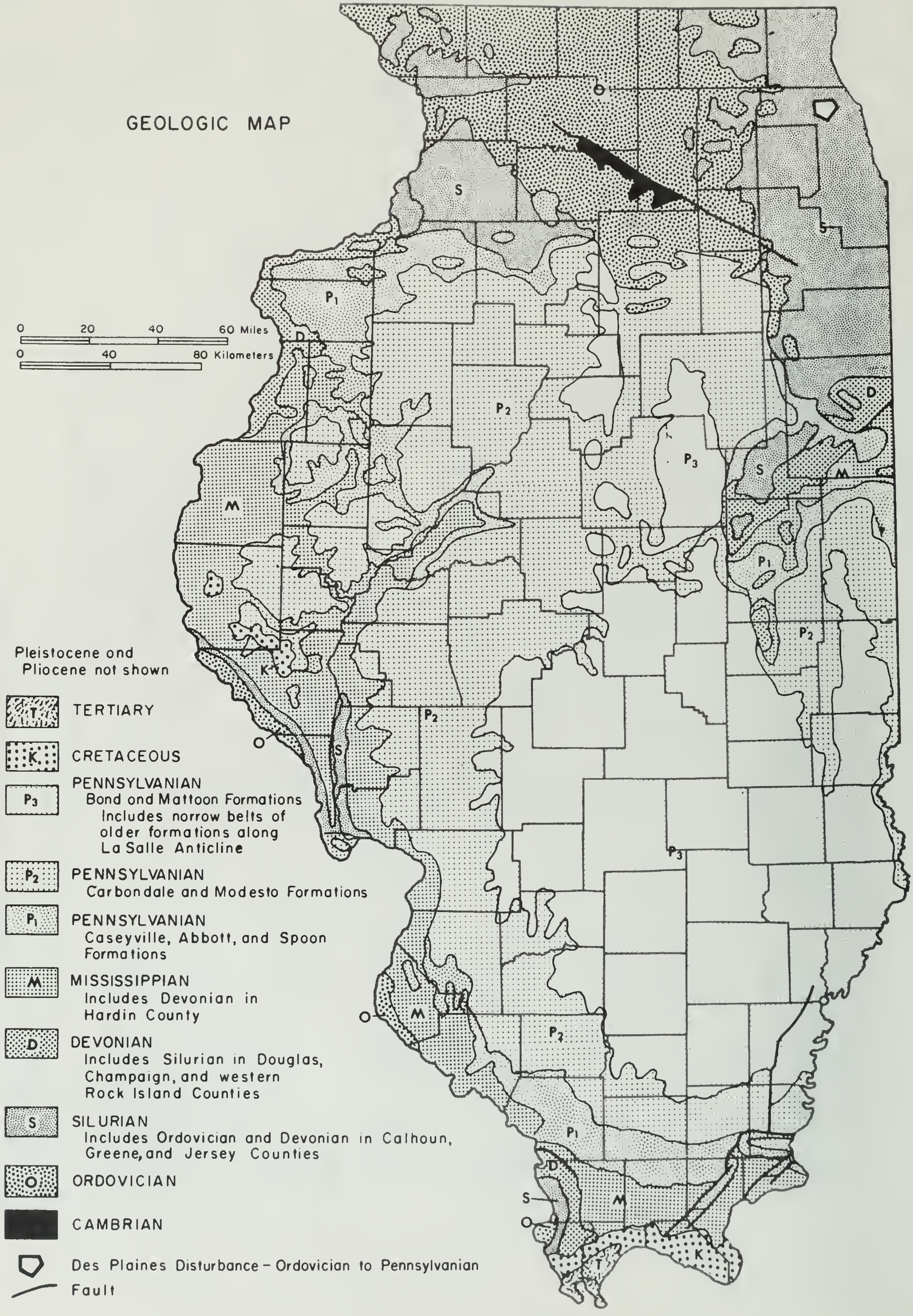




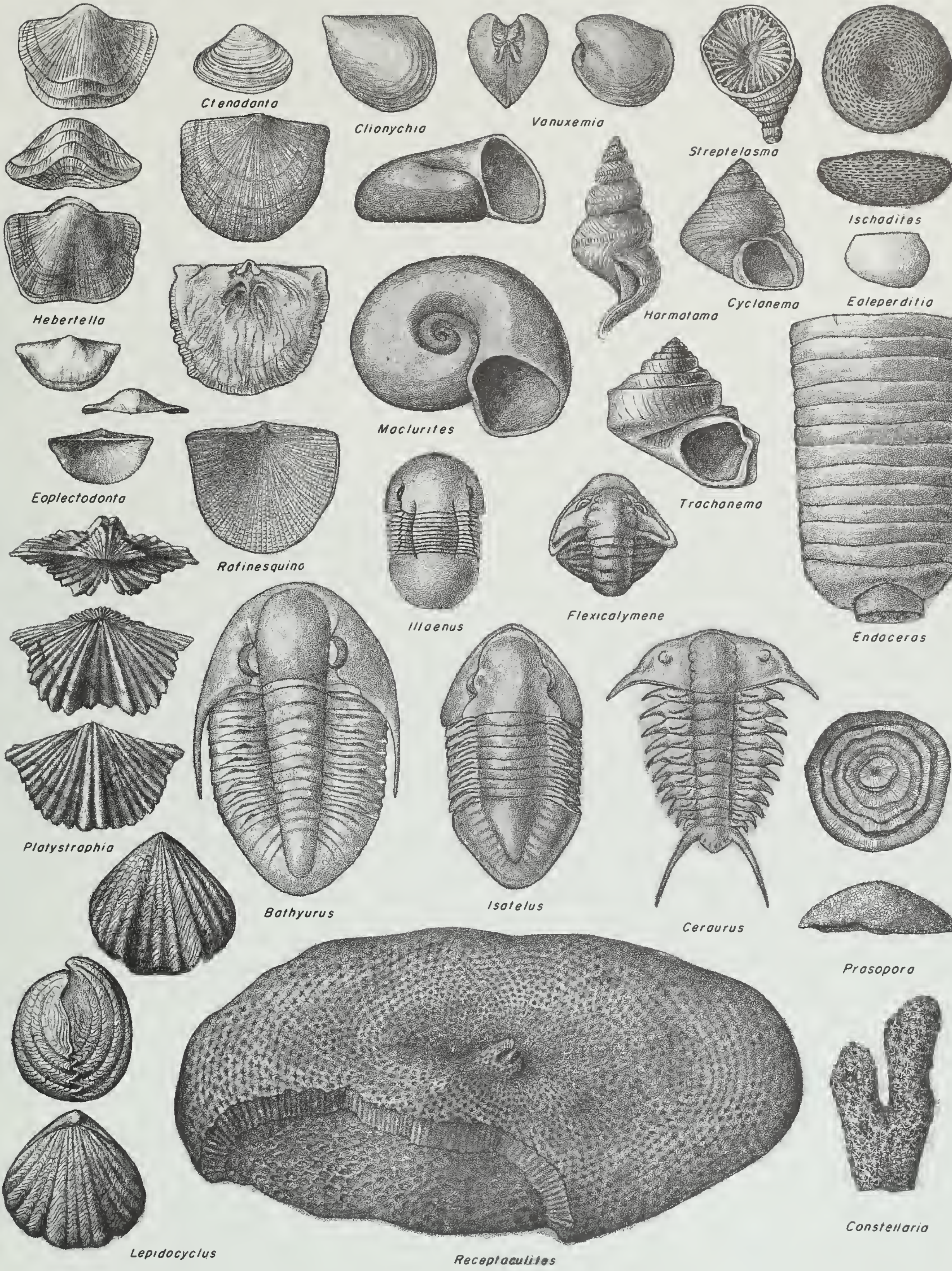
700 Contour showing surface elevation; interval 100 ft

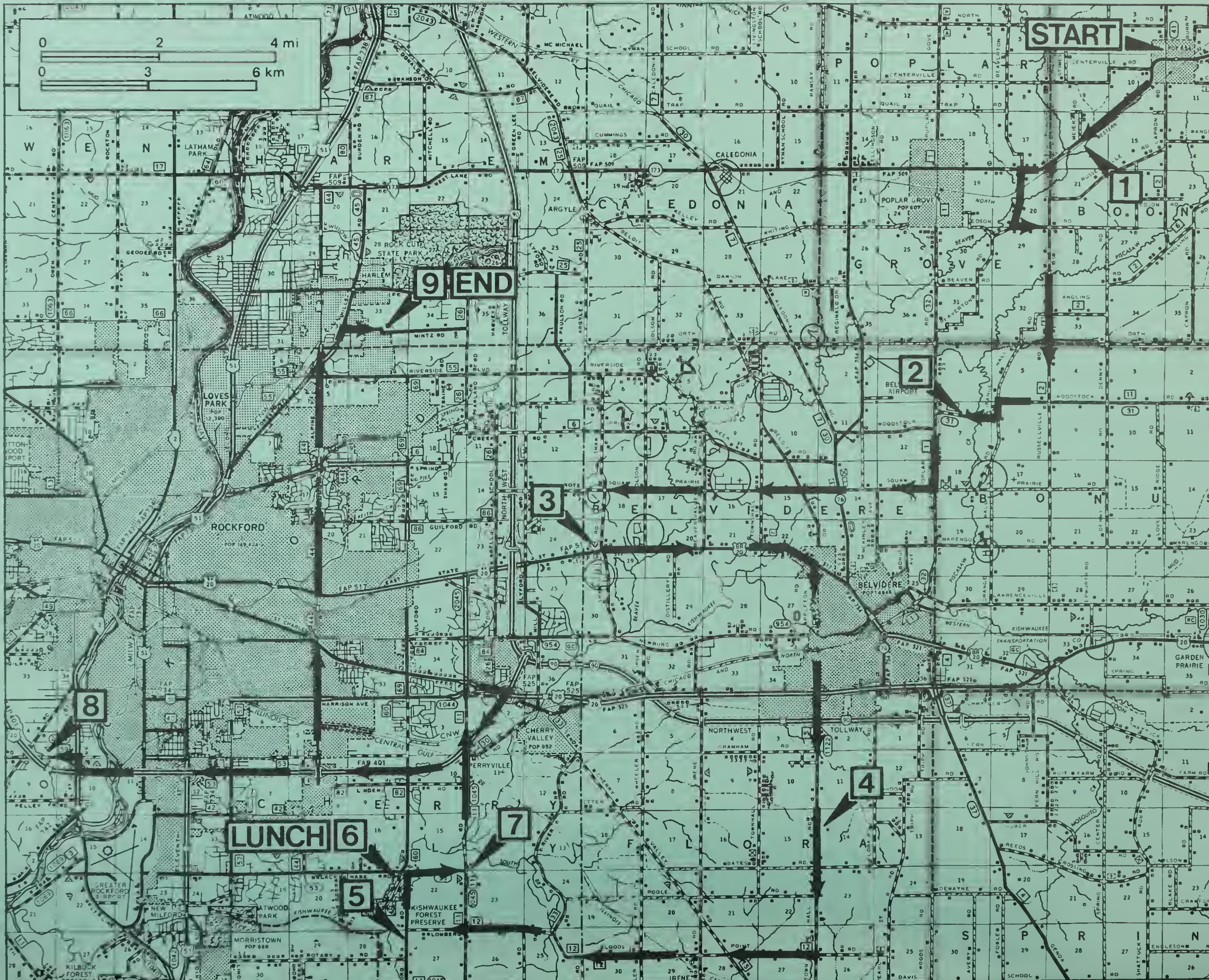
ISGS 1981

Summary of surface elevations in Boone and Winnebago Counties (contour interval 100 ft).


GEOLOGIC MAP
0 20 40 60 Miles
0 40 80 Kilometers
Pleistocene and Pliocene not shown
T TERTIARY
K CRETACEOUS
P3 PENNSYLVANIAN
Bond and Mattoon Formations
Includes norrow belts of older formations along La Salle Anticline
P2 PENNSYLVANIAN
Carbondale and Modesto Formations
P1 PENNSYLVANIAN
Caseyville, Abbott, and Spoon Formations
M MISSISSIPPIAN
Includes Devonian in Hardin County
D DEVONIAN
Includes Silurian in Douglas, Champaign, and western Rock Island Counties
S SILURIAN
Includes Ordovician and Devonian in Calhoun, Greene, and Jersey Counties
O ORDOVICIAN
CAMBRIAN
Des Plaines Disturbance – Ordovician to Pennsylvanian
Fault

ORDOVICIAN FOSSILS





START
1
2
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4
5
LUNCH 6
7
8
9 END
0 2 4 mi
0 3 6 km
ROCKFORD
LOVES PARK
BELVIDERE
CALEDONIA
POPLAR GROVE
CHERRY VALLEY
PERRYVILLE
GARDEN PRAIRIE
MORRISTOWN
NEW MILFORD
LATHAM PARK
ROCK CUT STATE PARK
KISHWAUKEE FOREST PRESERVE
KILBUCK FOREST PRESERVE
GREATER ROCKFORD AIRPORT
HARLEM
ARGYLE
TOLLWAY
NORTHWEST